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Critical Care Response During the COVID-19 Pandemic



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KEYWORDS

• COVID 19 • Critical care organization • sURGE LOGISItics • Health equity

KEY POINTS

- Critical care organizations play a central role in surge logistics for a hospital system.
- Critical care organizations, using the principles of the Four S's (space, staff, supplies, and systems), can best coordinate the response to health disasters, such as the COVID-19 pandemic.
- Critical care organizations can play a pivotal role in promoting health equity.

INTRODUCTION

The ongoing COVID-19 pandemic, which has led to the deaths of millions of people worldwide, serves to highlight the essential role critical care organizations (CCOs) plays in responding to a public health emergency. A CCO is an organization that integrates the business and operations of critical care, focusing on patient care, safety, and quality programs.¹ CCOs can be found in Academic Medical Centers (AMCs), non-AMCs, and across health care systems—in which case, the CCO serves multiple hospitals simultaneously. In ideal scenarios, a CCO will provide a common organizational structure and chain of command for critical care divisions and departments with

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the intention of enhancing throughput, instilling quality control, creating uniformity of care, and integrating critical care within the broader framework of the hospital or health care system.^{2,3}

A CCO differs from the traditional critical care model in several key details. Within the traditional critical care model, critical care is decentralized across various ICUs, which are staffed by physicians of different specialties (eg, anesthesia, surgery, medicine). Additionally, ICUs under the traditional critical care model function under their own leadership and have differing command structures, protocols, policies, and expertise with triage and admission of patients, dependent on the bed availability of the individual ICU.

Hospitals and health care systems with active CCOs (or other organizational bodies seeking to provide an organized response to the pandemic) were likely better positioned to address heightened demands during the ongoing COVID-19 pandemic for a variety of reasons. During COVID-19, hospitals and health care systems experienced unprecedented patient surges. When surges occurred, the unification of ICU services became especially important, as there was an enhanced need to rapidly triage patients, sustain communication across disciplines, and optimize care coordination when ad hoc ICUs were created to accommodate the patient influx. Further, during the ongoing COVID-19 pandemic, coordination from the national and state level to the hospital and health care system level was inconsistent, and so, in the absence of consistent government oversight, organizations like the CCO became more vital, as they were uniquely equipped to enact organizing and standardizing measures.

Before addressing what future steps might be taken by CCOs to encourage improved outcomes in the management of the COVID-19 pandemic (and future health emergencies), it is first necessary to examine recent experiences with pandemic response, both the triumphs and challenges, to learn from recent history. Throughout the COVID-19 pandemic, health care providers witnessed shortfalls in preparedness, on the one hand, and moments of success and innovation, on the other. Early in the pandemic, there was a dearth of personal protective equipment for front-line workers and a lack of available COVID-19 testing. As the COVID-19 pandemic progressed, the stark disparities rooted in race and ethnicity that exist within the United States were brought to the forefront of our consciousness, as we witnessed the outsized effect the pandemic had on Black, Indigenous, and People of Color (BIPOC). It is equally important to acknowledge the heroic efforts of nurses, respiratory therapists, physical therapists, and ancillary staff as well as the rapid response of governments, scientists, and the pharmaceutical industry. The latter allowed for the creation of a vaccine in a historically short period of time, as well as the performance of clinical trials (also conducted in record-time), which yielded multiple pharmacologic therapies that improved patient outcomes, summarized in the NIH guidelines for the treatment of COVID-19⁴

Extrapolating from these examples; mass coordination, cooperation, and organization are at the heart of the successful outcomes related to the pandemic response. It follows that a coordinated, cooperative, and organized critical care response is also of the utmost necessity. Moving forward, CCOs are uniquely positioned to enact meaningful change in this regard.

The purpose of this review is to identify the role the CCO plays in a pandemic response; to highlight which measures were effective and which were ineffective; and to make recommendations for what can be done differently in future scenarios to yield more favorable outcomes. This review will also serve as an after-action report of which preparatory measures were successful and which preparatory measures need improvement. Finally, this review will underscore the importance of both the material needs of a health care system and the human cost of practicing medicine during an ongoing pandemic.

Pre-COVID-19 PANDEMIC GUIDANCE AND THE CRITICAL CARE ORGANIZATIONS

In 2009, with the advent of H1N1 influenza, many medical centers and medical organizations began developing pandemic response plans. Before COVID-19, pandemic response guidelines were issued by the Society of Critical Care Medicine (SCCM), Institute of Medicine/National Academy of Medicine (IOM/NAM), Assistant Secretary for Preparedness and Response Technical Resources Assistance Center and Information Exchange (ASPR TRACIE), the American College of CHEST Physicians (CHEST).^{5–8} It is useful to review these early guidelines through the prism of the COVID-19 pandemic to understand how they are applicable and how they might also be expanded or qualified by CCOs in the future. Typically, these guidelines address 4 fundamental principles of disaster relief, known colloquially as the “Four S’s”: space, staff, supplies, and systems.

Ultimately, CCOs should be at the center of coordinating the “Four S’s” to ensure that the needs of each category are being met, and that the “Four S’s” are working in concert, as each category has bearing on the others. This is illustrated in **Fig. 1**. We will review how pre-COVID-19 guidelines measured up to the actual experience of COVID-19.

Space

With the advent of patient surges during a pandemic, space becomes a highly valuable resource. CHEST’s early guidelines, pre-COVID-19, point to the importance of using “deployable critical care assets,” or “field hospitals,” which have historically been implemented by the military and have only more recently been considered for civilian applications.

In New York City, The United States Naval Ship Comfort, treated 182 patients, while the Javits Convention Center treated more than 1000 patients.⁹ Additional field hospitals were established, with varying success at the United States Tennis Association U.S.T.A. Billie Jean King National Tennis Center and in Central Park. The former treated a total of 79 patients and cost 52 million dollars, while the latter had only 68 beds but was able to treat 315 patients.^{10,11} In London, the UK National Health Service (HS) established the Nightingale Hospital of London (NHL), a large capacity field hospital that could admit up to 4000 ventilated patients. This facility was constructed in an event space in 9 days. By the end of the first wave, the NHL had admitted a total of 54 patients.¹²

As these figures demonstrate, the use of deployable critical care assets was ultimately of limited utility. In the instances of the Naval Ship Comfort and the Javits Center, both deployable critical care assets initially only accepted patients with non-COVID-

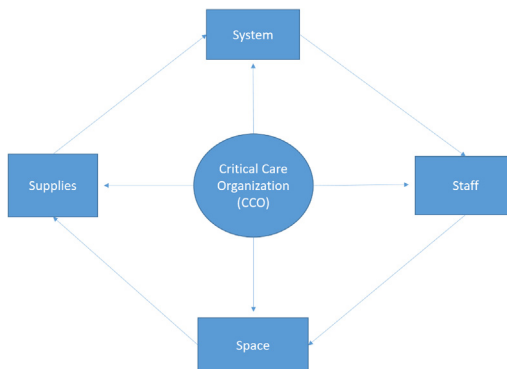


Fig. 1. The CCO as the central coordinator of the 4S's.

19, as their intended function was to ensure that care could still be administered in New York City to patients with non-COVID-19, while freeing up space in legacy New York City hospitals for patients with COVID-19.^{13,14} But during the COVID-19 pandemic, New York City experienced a reduction in patients seeking treatment of non-COVID-19 related reasons. Faced with this reality, both The Comfort and the Javits Center rethought their original plans and implemented new ones. The Comfort decided to accept patients with COVID-19, but required reconfiguration to effectively isolate patients with COVID-19 from patients with non-COVID-19.¹³ By the time the reconfiguration of the infrastructure was complete, the Comfort's expanded bed capacity was no longer needed, due to the decline in the number of patients with COVID-19 at that point. The Javits center also redesignated beds for patients with COVID-19 after a similar structural reconfiguration, but the strict criteria for admission limited the use of the 2500 beds made available.¹⁴ The strict criteria for admission stemmed from a concern that patients with COVID-19 who required surgery or ICU level care would not be able to receive adequate care at the Javits center, due to the nature of the facility.

In sum, the reduction in common clinical ailments for which New York City residents sought treatment during the 1st wave of COVID-19 and the fact that The Comfort and Javits Center was initially designed to accommodate patients with non-COVID-19 resulted in the limited utility of these deployable critical care assets.

Staff

The need to deliver a high level of care to an influx of critical care patients requires the services of highly trained staff, which predominantly consists of critical care nursing and respiratory therapists, working with advanced practice providers, hospitalists, residents, and intensivists. Moreover, an effective team approach can be achieved when medical staff from across specialties is working in concert to treat patients: whether it is the incorporation of physical therapists into a proning team or a pharmacist's insight into potential medication scarcity (and the pharmacist's recommendations for alternative regimens).¹⁵ Without this team approach, hospitals are unlikely to be able to offer the highest level of critical care to as many affected patients as possible. A CCO with long-standing working relationships with all intensive care ancillary specialties would be well-placed to rapidly deploy these staff to areas they are most needed. Ideally, CCO's would regularly convene interdisciplinary meetings to optimize preparedness so that the hospital is ready "the day before it's needed." For example, noncritical care providers, deployed to the critical care service in the event of a pandemic-related patient surge, require early or on-the-ground education on the nuances of providing support with devices with which they are unfamiliar.

While the expansion of the critical care team to include noncritical care personnel was an effective means of load-leveling, it allowed for the delivery of care, but not necessarily the highest level of care achievable in nonpandemic times. During the pandemic, the ratio of patients to nurse, respiratory therapist, advanced care provider, physical therapists, and physicians were higher than desirable. Many hospitals expanded the care team by having a critical care nurse oversee a medical/surgical nurse, allowing for a team approach to nursing care. In some cases, a CCO can ensure that this is uniformly done throughout the critical care system while providing just-in-time education and adhering to the scope of practice of each individual nurse.¹⁶

Supplies

The critical care surge medical workers experienced during the onset of the COVID-19 pandemic demonstrated firsthand that the stockpiling of equipment is paramount, as

is the inclusion of the hospital's various services (eg, pharmacy, laboratory, respiratory, and so forth) in the planning for a mass critical care incident.

As indicated in the stockpiling equipment guidelines, the targeting of specific supplies, which are usually on low par, may need to be adjusted and their acquisition should be increased before an anticipated event, as was seen during the outbreak of H1N1.^{17,18} Additionally, as suggested, "local" efforts can be augmented by a consortium of regional hospitals that can better provide and be prepared for a large scale, persistent event, such as COVID-19.¹⁹

Moving forward, emphasis should be placed on adhering to equipment stockpiling guidelines, while preevent planning should also consider the physical areas of a hospital that can store this equipment safely, accommodate patients on ventilators, and the need for oxygen delivery to those areas. Further, when accounting for supplies, ventilator supplies, transport ventilators, noninvasive machines, and anesthesia machines should all be accounted for. It would be additionally beneficial for central supply, or the equipment ordering entity for the hospital or health care system, to be included in any discussion of the stockpiling of equipment, as the lack of venous access devices, endotracheal tubes, stylets, and other critical devices is detrimental to patient outcomes.

Systems

Pre-COVID-19 guidelines regarding "systems" mostly focus on the issue of triage. Before the beginning of the 1st surge of COVID-19, the triage of the chronically critically ill out of the ICU allowed for the placement of the incoming sick into the ICU. As an example, at Montefiore Medical Center, (Bronx, NY), the critical care medicine service/CCO tasked the rapid response teams with the role of triage while having a centralized command center with whom to discuss triage decisions. This centralized command center was both an entity that would offer a second opinion and one that had the ability to track bed availability across the health care system and could thus facilitate transfers among the hospitals. The deescalation of non-COVID-19 services, the cancellation of elective procedures, and the conversion of outpatient care to telemedicine allowed for additional resources and providers to assist with the increased patient care demands. The critical care rapid response team and command center were also responsible for allocating noninvasive ventilation (NIV) and high flow nasal cannula (HFNC) to those in need of an elevated delivery of oxygen.²⁰

Indisputably, the COVID-19 pandemic laid bare the stark disparity in health equity that exists within the United States, with COVID-19 cases being 10% higher in Blacks and 30% higher among Latinx individuals when compared with White patients. An additional and critical statistical to note is that People of Color were three times more likely to be hospitalized, compared with their white counterparts.²¹ These differences extend to vaccination rates, as well. The Bronx can be viewed as a microcosm of the United States, wherein 50% of the population of the Bronx is vaccinated, but when looking at the racial breakdown, only 33% of Black people and 46% of Hispanic people had received the full vaccine as of 9/6/2021.²²

CCOs can play a crucial role in helping to combat racial disparity in access to health care, especially during a health disaster, such as COVID-19. During a pandemic, it is often the patients without privilege and access to resources whose health is impacted most severely, while patients with privilege tend to be impacted less severely but are also the ones with the greatest access to resources. Having a CCO at the helm can allow for the equitable distribution of resources to the patients most in need. The CCO can maintain an operational and a bird's eye view of all the resources available, redirecting patients as needed to sites that can accommodate them, especially during a patient surge, as was experienced during the COVID-19 pandemic.

Fig. 2 is a flow chart, demonstrating the core role that CCOs can play in providing standardization and organization during a pandemic, such as COVID-19.

PANDEMIC GUIDELINES ISSUED DURING COVID-19: A BRIEF REVIEW

As the COVID-19 pandemic progressed and evolved, additional guidelines, rooted in real-world pandemic experience, were released by many medical organizations, such as the NIH.⁴ For this review, we will focus on the guidelines issued by the Task Force for Mass Critical Care (TFMCC), but the reader is invited to compare with other organization's guidelines.²³

The TFMCC is a collection of experts from the fields of bioethics, critical care, disaster preparedness and response, emergency medical services, emergency medicine, infectious disease, hospital medicine, law, military medicine, nursing, pharmacy, respiratory care, and local, state, and federal government planning and response. This coalition of experts from various fields was then overseen by a steering committee comprised of representatives from the organizational members of the Critical Care Collaborative (CCC), as well as North American disaster experts, unaffiliated with CCC.²⁴ The TFMCC's additional suggestions built on their initial guidelines released in 2014. Their additional guidelines also incorporated modified versions of several existing sources, including: the World Health Organization's established rapid guideline methodologies and the Guidelines International Network-McMaster Guideline Development Checklist.²⁴⁻²⁷ Finally, the TFMCC's additional suggestions considered experiential evidence, peer-reviewed papers, and evidence from lay media sources.²³

It is helpful to review the TFMCC's additional guidelines as we contemplate ways CCOs can play an even more prominent role in pandemic response. The guidelines issued by the TFMCC can be found in **Table 1**.

Extrapolating from these guidelines, it is essential to acknowledge that it is optimal for the CCO to maintain adequate throughput, while also assisting in other areas of the

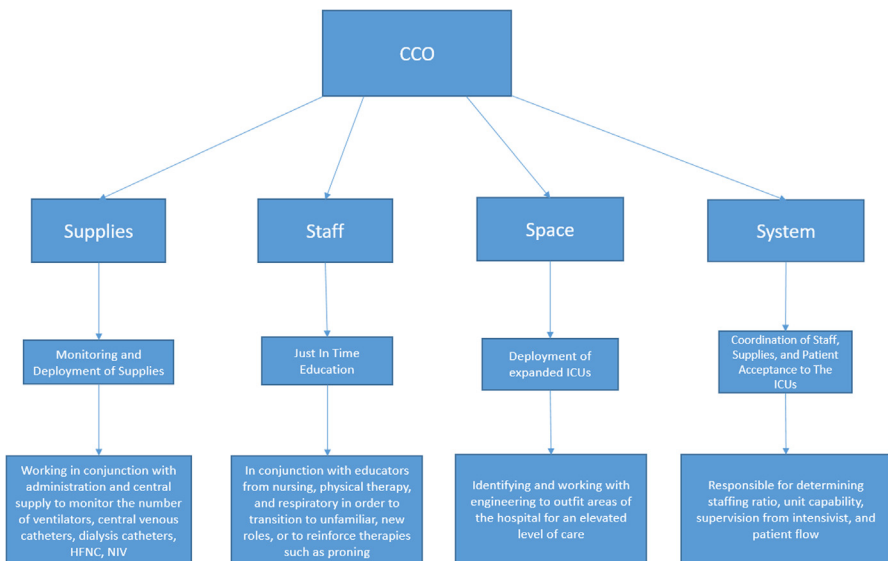


Fig. 2. The CCO coordinating in real time with various services to optimize, supplies, staff, system, and space.

Table 1
10 suggestions with 10 operational strategies for the 4 categories of staffing, load balancing, communication, and technology

Suggestions	Operational Strategy	Category
<i>Suggestion 1:</i> We suggest graded staff-to-patient ratios with consideration to experience level, resources, and patient acuity to optimize contingency care and avoid crisis care.	Three staffing models are presented to effectively scale up surge staffing to maintain contingency level care.	Staffing
<i>Suggestion 2:</i> We suggest limiting overtime to <50% above normal for all HCWs to minimize the risk of burn-out and exhaustion.	Limit overtime to <50% above normal for all staff to minimize the risk of burnout	Staffing
<i>Suggestion 3:</i> We suggest that the mental health needs of all HCWs are priorities for maintaining an effective response and staffing capacity.	Identify HCWs at risk for moral injury or exhaustion, address necessary preventative changes IN clinical care, and promote an informed supportive culture	Staffing
<i>Suggestion 4:</i> During surge, we suggest minimizing redundant clinical documentation requirements to focus on core elements directly relevant to bedside care.	Responsibly streamline documentation requirements	Staffing
<i>Suggestion 5:</i> We suggest that resource strain level be actively monitored and determined by front line clinical leaders based on the assessment of available resources and conditions.	Clinical leaders, ICU directors, and service chiefs should be empowered to determine local resources including strain indicators as being conventional, contingency, or at crisis levels	Load-Balancing
<i>Suggestion 6:</i> We suggest there is a transition zone toward the limits of contingency care when increasingly scarce resources are modified beyond routine standards of care to preserve life. This critical clinical prioritization level precedes triage of scarce resources and is a powerful indicator for needed resources to maintain contingency level care.	Educate clinicians to recognize critical prioritization to request resources or patient transfers; prepare decision support for potential crisis scenarios; prioritize communication systems for rapid access to ethical, legal, administrative counsel when triage of scarce resources is encountered	Load-Balancing
<i>Suggestion 7:</i> We suggest that early transfer of patients before a hospital is overwhelmed promotes the effective conservation of resources and less deviation from routine care standards.	Transfer(load-balance) patients early before a hospital are overwhelmed to maintain contingency level care	Load-Balancing

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Table 1 (continued)		
Suggestions	Operational Strategy	Category
<i>Suggestion 8:</i> We suggest earlier utilization of regional transfer centers for load-balancing during surge for patient transfers and placement. We also suggest having intensivist or hospitalist availability to help prioritize transfers and provide support to bedside clinicians when transfers are delayed.	Implement regional transfer centers to improve bed access and assure efficient ICU bed use through active management and load-balancing of admissions across all hospitals in a state or region. On-call Intensivists or hospitalist support should be available as a resource	Load-Balancing
<i>Suggestion 9:</i> We reemphasize that designated clinicians who are actively engaged in clinical work (especially intensivists and hospitalists) actively participate in hospital incident command structure; this group should provide updates to clinical staff for improving situational awareness, ensuring bidirectional communication.	Establish formal communication structures between incident command and front-line clinicians, such as PCSS/team to ensure bidirectional communication and situational awareness	Communication
<i>Suggestion 10:</i> We suggest hospitals apply telemedicine technology to augment critical care early and in the broadest sense possible.	Use telemedicine technology to support bedside critical care and connect specialty clinicians to distant sites and support visitation needs of families	Technology

From Dichter JR, Devereaux AV, Sprung CL, et al. Mass Critical Care Surge Response During COVID-19: Implementation of Contingency Strategies - A Preliminary Report of Findings From the Task Force for Mass Critical Care [published online ahead of print, 2021 Sep 6]. *Chest*. 2021;S0012-3692(21)03845-9. <https://doi.org/10.1016/j.chest.2021.08.072>; with permission.

hospital. Quaternary Care Centers are typically the de facto centers of specialty excellence for surrounding area hospitals, which often send their most complex patients from satellite campuses. Given this reality, health care systems need to have the ability to flexibly increase a fixed number of beds to accommodate an expanding patient pool. This is illustrated in **Fig. 2**. To ensure this process unfolds smoothly, regular exercises (simulated events) with the involvement of the CCO are essential, especially as the regionalization of health care and resources are still being established.

Furthermore, the provisioning of beds across a health care system is best orchestrated by the CCO working in conjunction with an intensivist, who can advise on whereby to properly triage patients, and, if those patients are delayed in their arrival to the hospital, assist with the management of those patients via telemedicine.²⁸ Involving an intensivist in this process also allows for the early recognition of a crisis, as well as the optimization of care and capacity to implement appropriate strategies to cope with the influx of patients. If ultimately necessary, the intensivist can also assist with the implementation of a standardized triage system.²⁹ This is demonstrated in **Fig. 3**.

In addition to focusing on patients, it is paramount to focus on the health and mental health of medical workers, per recommendation #3 of the TFMCC's guidelines. With increasing shortages of nurses, respiratory therapists, and intensivists, the need to provide preventative care to staff and to address moral injury or risk factors for burnout

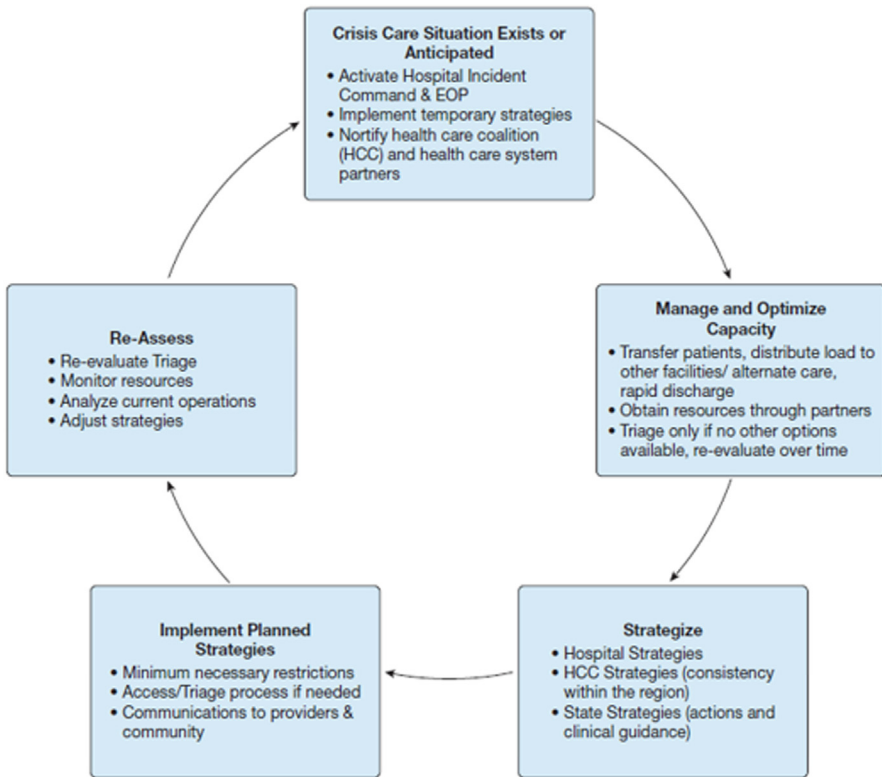


Fig. 3. Process for crisis care integration with incident command. (From Maves RC, Downar J, Dichter JR, et al. Triage of Scarce Critical Care Resources in COVID-19 An Implementation Guide for Regional Allocation: An Expert Panel Report of the Task Force for Mass Critical Care and the American College of Chest Physicians. *Chest*. 2020;158(1):212 to 225. <https://doi.org/10.1016/j.chest.2020.03.063>; with permission)

and exhaustion requires early recognition. Early recognition of burnout or moral injury cannot be achieved without first establishing open communication among the team. Incorporating a regular staff check-in, or at the very least issue a daily reminder of the psychological resources available to all staff members, helps to foster an environment of safety and lessens the risk of moral injury. A CCO can make sure these resources are distributed appropriately.

Though not specifically addressed in the guidelines circulated by TFMCC, the guidelines implicitly acknowledge the importance of a team approach and team learning. One of the many lessons the COVID-19 pandemic taught us is the importance of academic work during a crisis, and a CCO is uniquely positioned to ensure that this academic work is carried out. An optimal CCO will incorporate education and research as part of its core mission, which is critical to achieving up-to-date patient care. Ultimately, this academic integration facilitates a culture of patient safety and excellence of care through a thoroughly backed and supported quality improvement program. With appropriate funding and international reach, the research done by an academically integrated CCO allows for the rapid transmission of information to the world at large, which in turn, results in the cessation of ineffective treatments and the widespread adoption of optimal treatments.²

CRITICAL CARE EXPERIENCE DURING THE ONGOING COVID-19 PANDEMIC AT MONTEFIORE MEDICAL CENTER

As we consider future actions the CCO might take to improve care during the ongoing COVID-19 pandemic (and beyond), it is useful to consider not only the guidelines issued by various medical organizations before COVID-19 and the guidelines issued by various medical organizations during COVID-19 but also the measures individual hospitals and health care systems took during the pandemic to respond to their pandemic experiences in real-time.

Montefiore Medical Center (MMC), serves as an example: when the 1st surge began in March of 2020, the need to increase the number of ICU beds at MMC became paramount, which New York State reinforced when the governor required an increase of hospital bed capacity by a minimum of 50% to 100%. With 106 ICU beds across Moses, Einstein, and Wakefield, the number of beds was nearly tripled to 306 beds by the peak of the 1st surge.¹⁵ The CCO was involved in establishing these expanded ICUs, assisting in the education of nurses being transferred to those units, and providing care in the form of either direct patient care from an intensivist or via the E-ICU that had been established in the command center. These beds were created in areas of the hospital whereby the transition to delivery of advanced critical care would be most easily accomplished. These areas included: the step-down units, the Post-Anesthesia Care Unit (PACU), the Cardiac Care Unit (CCU), the Cardiac Catheterization Laboratory, the ICU at the Children's Hospital at Montefiore, and the operating rooms. Once the capacity of these areas had been exceeded, telemetry units were then converted into functional ICUs. As the 1st surge receded, these areas were returned to their preexisting purposes, except for the step-down unit at the Einstein campus, which remained an ICU.¹⁵

While MMC accomplished the expansion of critical care beds quickly, staffing these expanded units was a challenge. To cope with the expanded needs of these units, Certified Nurse Anesthetists, OR and PACU nurses, Nurse Practitioners, and ICU nurses were deployed. The CCO coordinated whereby these staff would be allocated and in what capacity. To staff, these units with providers, Head and Neck, General Surgeons, Cardiothoracic surgeons, Neurologists, Anesthesiologists, and critical care hospitalists were installed in the role of critical care attending. To assist with these expanded roles for the expanded provider base, the command center was outfitted with live monitoring as well as with critical care attending available 24 hours a day, 7 days a week. With the expanded need for renal replacement therapy across an increased number of units, perfusionists were cross-trained in managing CRRT.¹⁵

In terms of training, the original nursing staff for these units were given a boot camp in how to manage patients with COVID-19 facilitated by the CCO. They underwent briefing sessions that included primers on what to look for if their patient was decompensating; the medications with which they would need to become familiar (eg, sedatives and paralytics); and what their role would be during intubation. Additionally, they were given instruction in how to prone patients. To this end, the physical therapists and occupational therapists were deployed as a proning team to help with the sheer number of patients who required proning throughout the hospital. The ICU nurses who were deployed to these units also became the head of a nursing team, which would consist of nurses from that unit, outpatient nurses, or telemetry nurses. This organizational structure is illustrated in [Fig. 4](#).

As new COVID units were being created at MMC, the volume of patients the critical care rapid response team was treating increased in tandem, which led to the deployment of multiple rapid response teams to each campus coordinated by the command

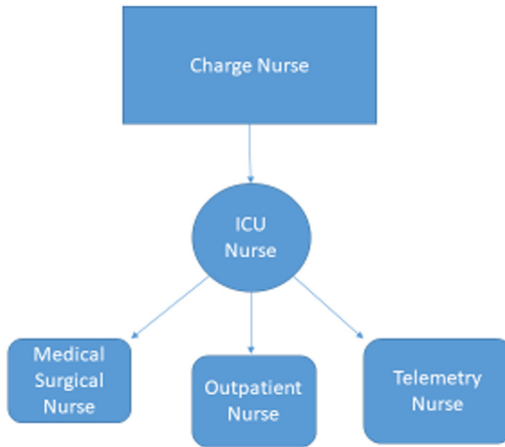


Fig. 4. Nursing team based around a critical care nurse.

center. These expanded rapid response teams were staffed by cardiology fellows at the Wakefield campus; critical care locum tenens and Nurse Practitioner volunteers at Einstein; and across all 3 campuses Certified Registered Nurse Anesthetists (CRNAs). These expanded critical care teams allowed for the rapid delivery of critical care to all areas of the hospital. They were also able to assist with the increased need for intubations, with up to 25 emergent intubations on patients with COVID being done per day.¹⁵ A solitary rapid response team was not enough to address the increased demand so additional teams were added. The rapid response team was also able to assist in the expanded ICUs, when needed, and was the action arm of the command center.

The establishment of a critical care command center allowed for the centralization of the available critical care resources. The command center consisted of 6 socially distanced workspaces, as well as remote access to the telemetry and waveforms of all the various critical care units. Once the command center was established, it helped to triage patients across multiple campuses, as the physician in charge of the command center not only knew whereby beds were available but also beds were already assigned. This alleviated the pressure on the rapid response teams and allowed them to focus on providing direct patient care, knowing that the patients accepted to the ICU would be sent to an open bed in either a legacy unit or one of the newly created ICUs. The command center also functioned as a hotline for the hospital at large, answering general critical care questions and assisting with the weaning of HFNC, ventilators, and NIPPV.

Load-leveling was a strategy that was used by some hospitals and health care systems, as well as entire cities, such as Detroit, throughout the pandemic to accommodate patient surges. At Montefiore Medical Center, patients deemed stable for transfer were moved to available beds across the 3 main campuses of Montefiore (Moses, Einstein, and Wakefield), as a means of using resources across multiple campuses. The transport ranged from ACLS transport in an ambulance to a medically capable bus that would bring patients from Einstein to Moses and vice versa. All transfers both within and without the hospital center were centrally handled by the CCO in the command center, with the goal of effectively balancing the patient load.

While the load-leveling system established at Montefiore was specific to their health care system, load-leveling occurred more widely throughout the pandemic and took

various forms. For instance, Detroit applied load-leveling across the city, using a Medical Operation Coordination Center, which was able to leverage all available beds to those in need.⁶

E-consult also played a central role in the pandemic response. Due to the highly infective nature of COVID-19, and limitations in PPE, E-consult allowed for the conservation of PPE, while still adequately maintaining expert consultation. To ensure uniformity across all areas of critical care, the CCO should make uniform guidelines for when E-consults from other specialties are acceptable and when in-person care should be done. Also, through telemedicine, E-consults for critical care services could be increased to allow critical care services to be more timely when stretched thin. Finally, it is interesting to note that a body of literature exists, pointing to the efficacy of E-ICU beyond the pandemic experience.²⁸

When discussing the realities of practicing medicine during COVID-19, it is essential to acknowledge the toll it has had on providers, which has been well-documented in surveys conducted by physician-scientists as well as in wide-ranging discussions in the media, with upwards of 45.8% of physicians reporting symptoms of burnout.³⁰ To alleviate burnout at MMC, and to establish a safe space in which to discuss what MMC providers were seeing and feeling during their rounds, clinicians from psychiatry met with the critical care team weekly. They also made themselves readily available to support physicians who wished to discuss their experiences in a more private setting. Internally, the critical care department developed a daily email, “the daily note of positivity,” which would include positive anecdotes from throughout the day (eg, a patient who was extubated, a heartwarming patient interaction, an example of effective multidisciplinary teamwork, or to highlight a new innovation in the care of patients with COVID-19).¹⁵

CONCLUSION: LESSONS LEARNED

The CCO is uniquely positioned to implement further changes that will help us manage the ongoing COVID-19 pandemic, as well as to apply the knowledge we’ve gained from this real-world experience to future pandemics. The implementation of international guidelines assisted in the care of patients and laid an important framework that was able to scale up as the need arose, but there are several additional initiatives that can now be implemented by the CCO to improve outcomes as we look toward the years ahead.

The first is the need for an increased critical care workforce and additional advanced practice providers. During a post 1st surge feedback session conducted at MMC, many of the nurses, critical care providers, and respiratory staff remarked on the deficit of critical care physicians during the 1st surge and the subsequent need for additional staffing. Second: while the COVID-19 pandemic was (and continues to be) an evolving situation, clarity in the form of recommended personal protective equipment early on in the pandemic would have gone a long way in fostering trust between staff, providers, and administration. The lack of PPE, due to increased demand and supply constraints, was predicted, but the impact on morale and the perception that those working bedside were undervalued, and to an extent unseen, is something to be avoided in the future. **Box 1** has a list of risk factors for health care worker burnout and moral injury. Third: As previously discussed in this review, the COVID-19 pandemic further revealed the racial disparities in access to health care and health care resources that exist within the United States. CCOs can play a vital role in achieving greater health care equality by redistributing resources and directing patients with limited resources to health care sites that can best care for them. In

Box 1**Risk factors for health care workers developing burnout and or moral injury****WORK ENVIRONMENT**

Inadequate access to personal protective equipment or essential supplies
 High perception of personal risk for infection
 Inability to rest
 Prolonged working times
 Excessive workload
 Working in a high-risk environment
 Involuntary deployment
 Perceived inadequate training
 Lack of sufficient communication and updated information
 Regret about restricted visitation policies
 Witnessing hasty end of life decisions
 Inadequate organizational support, insurance, or compensation

SOCIAL FACTORS

Fear of being infected
 Fear of spreading the illness to family and friends
 Inability to care for one's family
 Struggling with difficult emotions
 being quarantined
 Social rejection or isolation
 Moral distress
 Lack of social support

From Dichter JR, Devereaux AV, Sprung CL, et al. Mass Critical Care Surge Response During COVID-19: Implementation of Contingency Strategies - A Preliminary Report of Findings From the Task Force for Mass Critical Care [published online ahead of print, 2021 Sep 6]. Chest. 2021;S0012-3692(21)03845-9. <https://doi.org/10.1016/j.chest.2021.08.072> with permission.

conclusion, the CCO's unification of ICU units before the onset of the COVID-19 Pandemic, and the resulting standardization of care and integration of critical care within the larger structure of the hospital, positioned the hospital to be better equipped to adapt to the demands of the pandemic. CCOs should continue to make changes, based on the real experience of COVID-19 that would lead to improved care during the ongoing pandemic, and beyond.

CLINICS CARE POINTS

- The Four S's (space, staff, supplies, and systems) work as a foundational framework from which CCOs can build their response to a disaster.
- CCOs play a central role in a response to a disaster or pandemic.
- COVID-19 has highlighted the importance of health equity at every level of care.

DISCLOSURE

The authors have nothing to disclose.

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