NEJM Catalyst | Innovations in Care Delivery

ARTICLE

Collaborating Across Private, Public, Community, and Federal Hospital Systems: Lessons Learned from the Covid-19 Pandemic Response in NYC

Verity E. Schaye, MD, MHPE, Jenna A. Reich, Brian P. Bosworth, MD, David T. Stern, MD, PhD, Frank Volpicelli, MD, Neil M. Shapiro, MD, Kevin D. Hauck, MD, Ian M. Fagan, MD, Seagram M. Villagomez, MD, Amit Uppal, MD, Harald Sauthoff, MD, Michael LoCurcio, MD, FACP, Patrick M. Cocks, MD, Douglas B. Bails, MD

Vol. 1 No. 6 | November — December 2020

DOI: 10.1056/CAT.20.0343

In the spring of 2020, New York City became the epicenter of the Covid-19 pandemic in the United States. During the peak from March 10 to May 1, the hospitals of the Department of Medicine at New York University Grossman School of Medicine — including an academic, private hospital in a community setting, a private hospital, an affiliated public hospital, and an affiliated Veterans Affairs federal hospital — cared for more than 5,000 hospitalized patients with Covid-19. Each hospital encountered unique challenges based on its own resources, affiliations, size, and patient populations. However, with ongoing collaboration, leadership developed protocols applicable across sites. Despite these four hospitals being distinct, these collaborations resulted in many strategies that can be applied to a wide variety of medical centers that must rapidly respond to the unprecedented challenges created by the Covid-19 pandemic. In this article, the authors describe strategies for communication, surge planning, clinical care, and staff wellness.

When the novel coronavirus (severe acute respiratory syndrome coronavirus 2 [SARS-CoV-2]) began spreading in Wuhan, China, epidemiologists recognized the potential global impact.[1] Models warned that highly infectious SARS-CoV-2 combined with the prolonged critical illness of Covid-19 would overwhelm health systems.[2-4] The World Health Organization's pandemic declaration and news of several overwhelmed European health systems in March 2020 made this prediction a reality.[5,6] New York City (NYC) soon became an epicenter of the pandemic, with 168,845 of the

1,122,486 cases nationwide as of early May 2020.[7,8] To help health care systems in the United States prepare for the pandemic, the Centers for Disease Control and Prevention published general guidelines, and several health systems have shared their own strategic models.[9-16] However, local factors based on patient populations, affiliations, geography, and politics can influence the application of published guidelines. Therefore, a detailed description of an institutional response highlighting uniform approaches that are applicable in different systems and which unique strategies may be required can help prepare hospitals yet to experience peak disease activity and to plan for potential future surges.[17]

This article focuses on our experiences — caring for more than 5,000 hospitalized patients with Covid-19 over 2 months — in the Department of Medicine at New York University (NYU) Grossman School of Medicine, through NYC locations across four hospital sites: NYC Health + Hospitals/Bellevue Hospital (BH), NYU Langone Health–Tisch/Kimmel Hospital (NYU-Tisch), NYU Langone Hospital–Brooklyn (NYU-Brooklyn), and the Veterans Affairs New York Harbor Healthcare System (VA). The relationship of these NYU-affiliated hospitals offers a unique perspective on the pandemic. These hospitals participate in the educational programs of the internal medicine residents, medical students, and subspecialty fellows, in addition to sharing many clinical protocols across sites. However, these four hospitals have different funding mechanisms, organizational hierarchies, and supply chains. In this article, we highlight the coordinated response and the nuanced challenges that each hospital faced during the Covid-19 pandemic. We focus on four core domains based on challenges faced: communication strategies, development of surge capacity (expansion of beds, staffing, and patient triage), clinical care, and staff wellness (Table 1).

Within the collaborative model of these four different hospitals, there are many practical tools that may be used as a template by medical centers of any affiliation or size, in addition to some areas in which varying approaches may be required depending on the hospital system.

Hospital Systems and Department of Medicine Structure

The Department of Medicine at NYU uses four main hospital sites: BH, NYU-Tisch, NYU-Brooklyn, and the VA. Each hospital has site-specific leadership with a chief of medicine, each of whom reports to their respective chief medical officers; each of the four chiefs of medicine also reports to a single chair of medicine through their academic affiliation with NYU. Directives from these lines of leadership typically align; however, the chiefs of medicine negotiate any conflicting directives or priorities when they arise (Figure 1).

Table 1. Challenges Faced and Strategies Used in Covid-19 Pandemic Planning

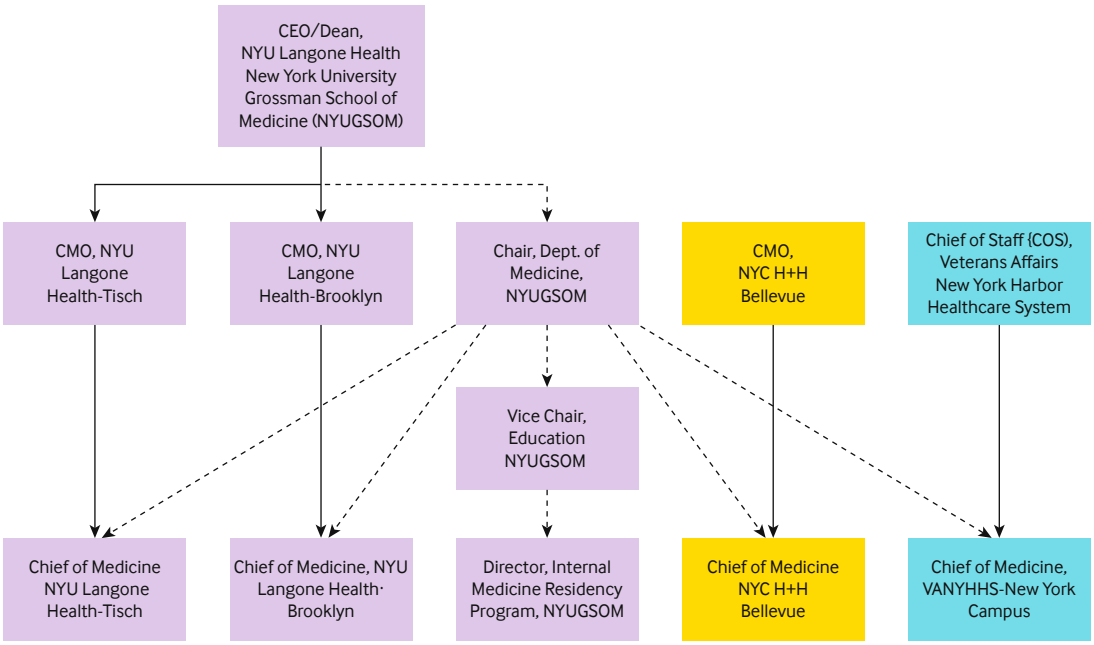
Domain of Response	Challenge Faced	Strategy Used	Next Steps
Communication	Volume of information and pace of change; need for leadership to coordinate plans within each hospital and between hospitals and disseminate information	Frequent and multiple modes of communication to accommodate different communication styles	Develop multimodal communication strategies and tailor these strategies to the needs of staff; communicate within affiliated hospital systems and colleagues at other institutions
Surge capacity and expansion of beds	Sufficient ICU beds, negative pressure rooms, and continuous oxygen saturation monitoring	Transformed rooms to accommodate negative pressure and continuous oxygen monitoring needs; revitalized previously closed units; identified areas that could be converted to flex-ICU spaces	Ensure sufficient readily available flex-ICU spaces given that upwards of 25% of Covid-19 hospitalizations required this level of care
Staffing	Sufficient staff to care for the rapid increase in patient volume with a particular strain on ICU nurse staffing; onboarding of staff new to the system or clinical area	Creation of staffing pools via multiple methods, including ambulatory care physicians and nurses and agency staffing; construction of teams to ensure sufficient expertise within a team; creation of robust onboarding programs	Not all of the same sources of staffing pools will be available for the next wave as the rest of the country is impacted; will need to be more dependent on internal staffing pools and less on volunteers and agency; early training of physician and nurses to prepare for ICU care
Triage	Separation of respiratory and nonrespiratory patients on admission; need for processes to accommodate internal transfers and external referrals	Dedicated respiratory and nonrespiratory areas of the ED; systems in place for identification of transfers and handoffs	Continued planning for dedicated respiratory and nonrespiratory areas of the ED, as it is likely there will be more of a mixture between patients with and without Covid-19 in next wave
Clinical care	Given limited evidence and a novel disease, there were many areas of clinical uncertainty	Working collaboratively to develop protocols in key areas such as respiratory failure, renal failure, code teams, and end-of-life care in addition to therapeutic management of Covid-19	Continue to work collaboratively across sites (not just within affiliated institutions) and share evolving clinical guidelines and systems protocols
Staff wellness	Covid-19 has created an unprecedented challenge to all health care workers	Access to mental health professionals and resources such as meditation, yoga, and schedules with sufficient time off to decompress	This is a marathon, not a sprint; there is a need for ongoing programs for staff wellness

Source: The authors.

FIGURE 1

Organizational Structure of NYU Grossman School of Medicine's Department of Medicine and Its Affiliated Hospitals

The chiefs of medicine at each hospital report to their respective chief medical officers (CMOs) (solid lines) as well as to a single chair of medicine though their academic affiliations with the NYUGSOM (dashed lines). H+H = NYC Health + Hospitals, VANYHHS = Veterans Affairs New York Harbor Healthcare.



Source: The authors.

The hospitalists and primary care doctors do not rotate among the facilities, instead providing their clinical care at one of the four sites, as designated. Several of the critical care attendings staff the ICUs at more than one site, and many of the subspecialty faculty also rotate among hospitals. The NYU internal medicine residents, medicine subspecialty fellows, and medical students rotate among all of the clinical sites.

The four hospitals are distinct in their patient populations, size, infrastructure, affiliations, and business models (Table 2 and Figure 2).

Table 2. Comparison of Four Hospitals Affiliated with the Department of Medicine at NYU

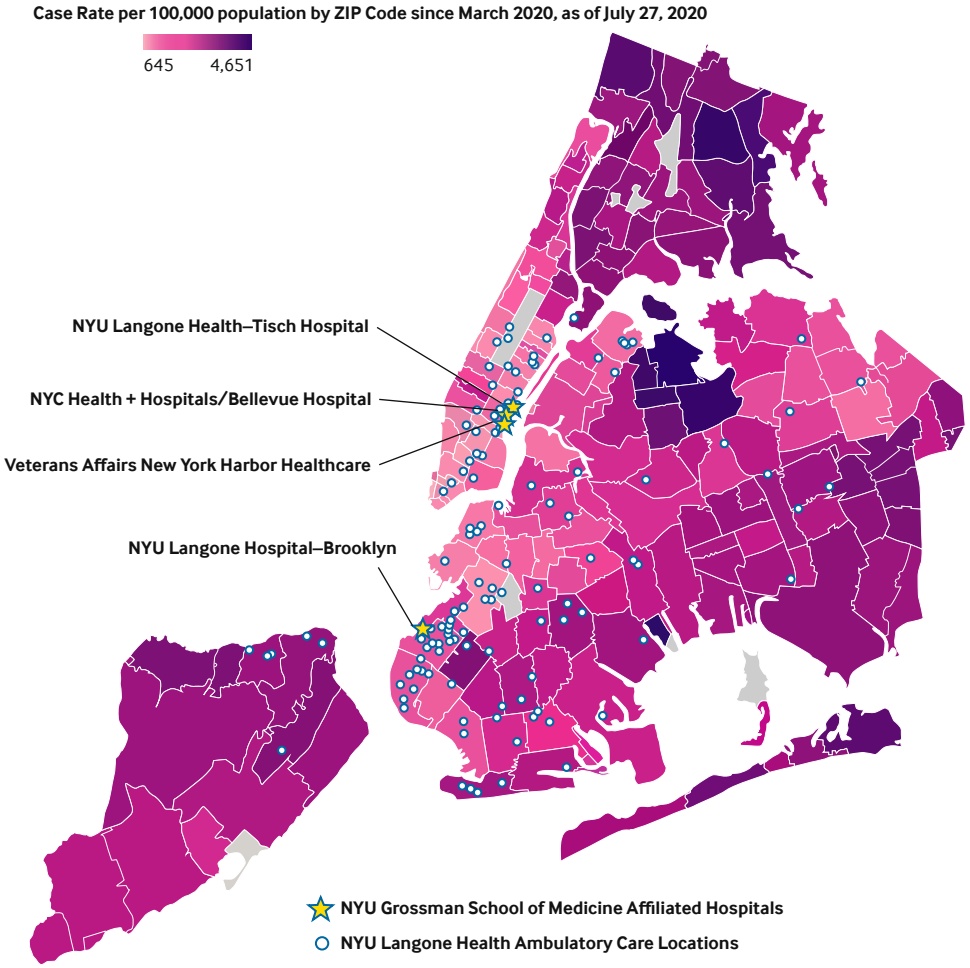
Hospital	BH	NYU-Tisch	NYU-Brooklyn	VA
Affiliations	Tertiary referral center of NYC Health + Hospitals	Quaternary referral center and additional orthopedic hospital within NYU Langone Health Network	Specialty referral center of NYU Langone Health Network	Regional specialty referral center, specifically for cardiovascular and neurosurgical disease, within the Veterans Integrated Service Network 2 (VISN2)
Location	New York, NY	New York, NY	Brooklyn, NY	New York, NY
Financial structure	Public nonprofit	Private nonprofit	Private nonprofit	Federal nonprofit

Source: The authors.

FIGURE 2

Map of NYC and Location of the Four NYU Affiliated Hospitals

Although case rates in Manhattan — where three of the four hospitals are located — were not as high as in the other harder-hit boroughs in NYC, the NYU affiliated hospitals received many transfers from areas of NYC with higher case rates.



Source: The authors and NYC Health. COVID-19: data. The Official Website of the City of New York. Updated May 3, 2020. Accessed July 27, 2020. https://www1.nyc.gov/site/doh/covid/covid-19-data.page.

BH is the tertiary referral center for the 11 acute-care facilities of NYC Health + Hospitals — an $8 billion public health care system. NYU-Tisch is composed of a quaternary-care referral center as well as a separate orthopedic hospital. NYU-Brooklyn, also a specialty referral center, is an academic hospital in a community setting in Brooklyn. The VA is a two-hospital system in Manhattan and Brooklyn, within the VISN2. It serves as the regional specialty referral center for veterans with cardiovascular and neurosurgical disease.

Communication Strategy

In times of crisis, effective communication from leadership is essential to disseminating information and can ameliorate anxiety and fear.[12,18] The sheer volume of information and rapid pace of change made disseminating this information to a large number of staff very challenging. In accordance with crisis communication strategies,[19,20] all four sites used multiple modes of communication including intradepartmental operations calls, town halls, daily videoconferences, and emails to engage staff, answer questions, and alleviate concerns (Table 3).[18]

Independently, all four hospitals used twice-daily site-specific operations meetings with multidisciplinary leadership from key departments (e.g., general medicine, critical care, ED, psychiatry, nursing, facilities, and infection control). These meetings focused on data updates, departmental reports, and ongoing feedback to identify areas for systems improvements. Additionally, the chiefs of medicine from all four sites communicated on a daily Department of Medicine call. During these discussions, leadership across sites shared experiences, discussed facilities and staffing challenges, assisted each other in obtaining supplies, and shared clinical protocols. Information shared during these meetings resulted in collaborative solutions for major challenges such as renal replacement therapy and development of peritoneal dialysis programs and coordination of staffing as detailed in the sections below.

> *"Efficient communication within and among the four hospitals was vital and strengthened our ability to respond in each unique system of care; hospitals should ensure they have multimodal communication strategies for leadership and frontline staff."*

To disseminate information generated from these leadership meetings to frontline staff, we used multiple modes of communication strategies, including emails, videoconferences, town halls, and Slack. Some of these communications were group specific (e.g., residents or faculty) to address issues unique to them, and some were inclusive of all. For the residents, who rotated frequently among sites, communication via Slack proved to be an effective means of conveying site-specific information. In addition, residents received nightly updates from the internal medicine residency program director that consolidated information on patient volume, major systems changes, and ongoing challenges generated from the four chiefs of service.

Table 3. NYU Department of Medicine and Hospital Site Communication Strategies

Communication Strategy	Multisite Communication			Hospital Site-Specific Communication	
Meeting type	NYU Department of Medicine leadership planning	Residency program updates	NYU all-staff town hall	Site-specific updates*	Hospital site operations planning
Leader/organizer	Chiefs of medicine and residency program leadership	Internal medicine residency program director	Chair of medicine	Chief medical officer, chief of medicine, section chiefs, chief nursing officer, and site-specific residency leadership	Chief medical officer
Target audience	NYU Department of Medicine leadership	All internal medicine residents (across sites)	All clinical and nonclinical staff	All staff, faculty and advanced practice providers, nursing, residents	Leadership of departments
Frequency	Daily	Daily	Twice a month	Daily	Twice a day
Method of communication	Webex	Email	Webex	Webex, emails, Slack, in person but socially distanced in small groups	Webex
Goals	Share experiences and challenges	Site-specific clinical guidelines updates	Site updates on patient volumes, outcomes, operations planning	Site updates on patient volumes, protocol changes, PPE guidance	Patient volume and supplies updates
	Assist in obtaining supplies	Patient census and supply updates	Answer questions and concerns	Answer questions and concerns	Department reports
	Discuss current clinical guidelines and necessary modifications	Scheduling changes	Staff engagement	Staff engagement	Identification of gaps and planning needs
	Strategize on resident and fellow site allocation	Wellness initiatives			

PPE = personal protective equipment. *For site-specific updates, some communications were provider group–specific (e.g., only for residents or for nurses), and some were more global; the leader of the meetings was dependent on the target audience. Source: The authors.

Efficient communication within and among the four hospitals was vital and strengthened our ability to respond in each unique system of care; hospitals should ensure they have multimodal communication strategies for leadership and frontline staff.

Development of Surge Capacity

During the 2 months of the peak in NYC from March 10 to May 1, 2020, the hospitals of NYU cared for more than 5,000 patients with Covid-19 (NYU-Tisch, 2,180; BH, 1,186; NYU-Brooklyn, 1,356; and VA, 467; at peak census in early April, the hospitals had, respectively, 550, 396, 303, and 85 patients with Covid-19). Each site had plans for additional surge capacity beyond the peak census reached. NYU-Tisch was prepared for 434 ICU and 590 medicine bed capacity; BH, 200 ICU and 371 medicine bed capacity; NYU-Brooklyn, 78 ICU and 295 medicine bed capacity; and VA, 44 ICU and 70 medicine bed capacity. Staffing and equipment plans for these maximum planned bed capacities were ongoing at the time the peak census was reached and never ultimately required. With the exception of the VA, the medicine and ICU services at the three other hospitals comprised patients with Covid-19 almost entirely, with few or no non–Covid-19–related admissions during this time. Similar to what was occurring at other institutions, many of these patients had a high level of care needs, including continuous monitoring and ICU admission.[21,22] To accommodate this demand, all four affiliated NYU hospitals developed systems to expand medicine and ICU bed capacities, to transform rooms to accommodate specific needs such as

negative pressure and continuous oxygen saturation monitoring, to expand and onboard staff, and to develop systems to handle the triage of a large volume of Covid-19 admissions (Table 4).

Expansion of Medicine and ICUs

In each hospital, previously closed units were revitalized and designated as Covid-19–specific floors. Neurosurgical, cardiac, and surgical ICUs and post–anesthesia care units, in addition to transplant centers and operating rooms, were converted to ICUs for patients with Covid-19. Many Covid-19–designated areas were converted to negative pressure, a crucial change in airflow used to control infectious spread of Covid-19. This process was completed on the basis of each hospital's heating, ventilation, and air conditioning system. Newly constructed buildings within the NYU-Tisch network were equipped with built-in ventilation systems that could be easily adjusted to negative pressure. Some of these areas also had hardwired bedside-monitoring capabilities that facilitated rapid expansion of ICUs. However, in older NYU-Tisch and NYU-Brooklyn facilities as well as in BH and the VA, rooms needed to be converted to negative pressure using high-efficacy particulate air filtration units and other specialized ventilation systems. At BH, several medicine units were also outfitted with continuous pulse oximetry monitoring, an essential need for the care of patients with Covid-19, while the VA increased its telemetry capacity to meet the same demand.

In anticipation of a second wave, all four sites are planning continuously for additional flex-ICU spaces to ensure sufficient capacity; during the first wave, at least 25% of hospitalized patients with Covid-19 required ICU level of care. Hospitals considering further preparation for pandemics should consider a model with hospital rooms that may be converted immediately to negative pressure with ICU or advanced monitoring capabilities; approaches to achieve this may differ on the basis of the hospital system, as it did across our four sites.

Approach to Staffing and Onboarding

As Covid-19–specific units were built, the need for additional clinical staff grew, including the establishment of backup pools for surge and illness.[11,15] There were four major considerations shared across sites in this approach: (1) source of staff; (2) onboarding of staff; (3) construction of teams to ensure sufficient expertise within teams; and (4) schedules to ensure time off and backup pools.

Source of Staff

There was variation across sites in how staff was recruited to meet the needs of this growing segment of the patient population. However, across all sites, cancellation of elective procedures and conversion of the majority of outpatient visits to televisits expanded the pool of physicians and nurses to deploy to the inpatient units. For all sites, the majority of additional staffing was recruited from this outpatient pool of clinicians. As hospitals that are associated with a network of ambulatory sites, NYU-Tisch and NYU-Brooklyn redeployed attending physicians, advanced practice providers, and nurses from the outpatient NYU network to the newly implemented Covid-19 medicine units and ICUs. Though this level of redistribution may be more difficult for smaller hospitals, this strategy provided a more fluid onboarding and accreditation process that was essential in rapidly deploying the necessary staff. At BH, NYU-Brooklyn, and NYU-Tisch — in addition

Table 4. Development of Surge Capacity at the Four Affiliated NYU Hospitals

Clinical teams, patients, and surge sources	BH		NYU-Tisch		NYU-Brooklyn		VA	
	Pre–Covid-19	Peak surge	Pre–Covid-19	Peak Surge	Pre–Covid-19	Peak Surge	Pre–Covid-19	Peak Surge
General medicine teams	12	22	13	29	9	20	3	4
Total nursing staff, General medicine (per shift)	30–40	90–100	40–50	110–120	30–35	40–44	24	40
Medical ICU teams	1	8	1	11	2	7	1	3
Total nursing staff, ICU (per shift)	24	55	15	165	14	30	24	42
Patients: peak census reached* (general medicine and ICU)	220	396	206	550	180	303	42	85
Primary source of admissions and triage locations	Majority transfers from other NYC H+H; some directly through the ED		Directly through the ED		Directly through the ED		Transfers from other hospitals by enacting VA's Fourth Mission** and via ED	
	Designated respiratory and nonrespiratory areas in the ED		Designated respiratory and nonrespiratory areas in the ED		Designated respiratory and nonrespiratory areas in the ED		Specific respiratory rooms within the ED	
Sources of expansion (space and staff)	Space: opening and revitalizing previously closed units; identification of flex-ICU spaces (e.g., operating rooms and endoscopy); converting rooms to negative pressure; and outfitting rooms with continuous pulse oximetry							
	Staff: ambulatory care physicians and nurses, volunteers, agency staff, redeployment at the VA via the DEMPS, and resident and fellow redistribution across sites on the basis of need							

H+H = Health + Hospitals, DEMPS = Disaster Emergency Medical Personnel System. *Expanded surge capacity was planned, but ultimately not needed. NYU-Tisch was prepared for 434 ICU and 590 medicine bed capacity; BH, 200 ICU and 371 medicine bed capacity; NYU-Brooklyn, 78 ICU and 295 medicine bed capacity; and VA, 44 ICU and 70 medicine bed capacity with ongoing plans of how to staff this maximum bed capacity. **The Fourth Mission is a VA preparedness plan (https://www.va.gov/health/coronavirus/statesupport.asp). Source: The authors.

to redeploying outpatient attendings, nurses, and advanced practice providers — the medicine subspecialty, neurology, and surgical faculty were deployed to staff the medicine and ICU services. Additionally, BH hired many advanced practice providers, nurses, and attendings via agency staffing. NYU-Tisch and NYU-Brooklyn similarly employed agency-supplied nurses. At BH, nurse staffing was also supplemented by military staffing. However, limited reserves still existed for critical care nurses across sites. A small number of volunteer attendings from outside the institution, including several prior residents and faculty at NYU, served on the front lines as well. At the VA, the service redeployed general internal medicine and medicine subspecialty faculty, in addition to hospitalists, to staff teams. After the availability of on-site medical staff was exhausted, the VA DEMPS was activated to reallocate physicians and nurses from VISN2 (the VA's health care network that covers the states of New York and New Jersey) and other networks across the country. The redistribution of clinicians, however, did not allow for rapid movement, and the demand for physicians and nurses by several other VA medical centers around the country delayed the DEMPS deployment.

> *"Hospitals considering further preparation for pandemics should consider a model with hospital rooms that may be converted immediately to negative pressure with ICU or advanced monitoring capabilities."*

Graduate medical education (GME) staffing was administered through a collaborative effort between the GME office and the internal medicine residency program. Internal medicine residents

were placed into three-resident clusters with a preset 6-day-a-week, 12-hour-a-day call schedule regardless of the rotation to which they were assigned (e.g., ICU, wards, sick-call). This allowed for modular deployment of clusters, limiting concern about day/night transitions as well as ensuring that at least one member of the team was present at all times for patient–physician continuity.

As our clinical needs escalated, non–internal medicine GME volunteers were queried about potential roles they could serve, with consideration of their knowledge and skill sets (e.g., acute-care medicine postgraduate year 1 [PGY1] level work, ICU PGY1, emergency medicine PGY1, proning team, procedure team, and fellow functioning as a hospitalist attending). These residents were added to our three-person clusters, and a GME resource database was created to track the potential roles for assignment, the dates the residents were able to be deployed, and the hospitals to which they were credentialed. Working with the chiefs of medicine, the three-person resident clusters were then deployed to clinical areas most in need among the four hospitals determined by current staffing levels and patient volumes based on daily assessments. Fellows served in the hospitalist attending role across sites and were granted emergency credentialing as attendings coordinated by division administrators. Focus on hospital need rather than funding source (how many resident and fellow lines each site funds) allowed for rapid redeployment of the residents and fellows.

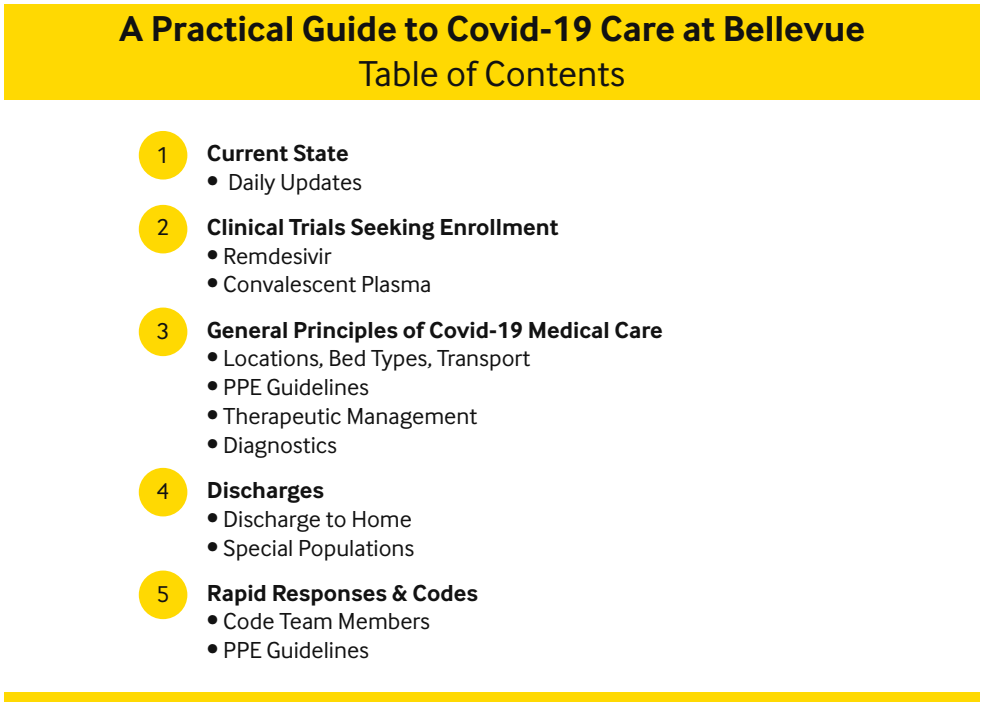
Onboarding of Staff

Creating robust onboarding plans was required for all staff: both those familiar with the clinical areas but treating a new disease and those new to clinical areas. Each site held focused weekly 60- to 90-minute orientations to the clinical service with a focus on the treatment of Covid-19. This was supplemented by a Covid-19 handbook created at each site (Figure 3). Although each site had variations of the Covid-19 handbook particular to their unique system, collaborating across sites that shared best practices created a common framework for these guides.

FIGURE 3

Table of Contents for a Hospital-Specific Electronic Orientation Guide for Covid-19 Clinical Care Used by Frontline Clinicians (BH)

Each of the four hospitals had site-specific orientation training. This table of contents for the Covid-19 care manual at BH represents an individualized component of the materials used, although some of the content would be common to all sites.



Source: The authors.

To provide additional training to physicians and advanced practice providers for staffing the ICUs, our Division of Pulmonary and Critical Care designed a half-day training course in the VA Simulation Center (a shared resource for the NYU Grossman School of Medicine). Attending physicians, fellows, and residents from all four sites were provided with a refresher course on ventilator management, pressor use, line placement, and point-of-care ultrasound. Through this course, we trained 116 physicians and 59 advanced practice providers to expand coverage for our ICUs across the NYU system.

Team Construction

Across all sites, teams were constructed to ensure balance between level of expertise and knowledge of the system, given that many staff were working in clinical areas not in their regular scope of practice. This was essential to ensure the safest care possible. For example, a subspecialty attending was paired with internal medicine residents and non–general internal medicine residents, or agency advanced practice providers were paired with a full-time hospitalist familiar with the

hospital system. Each ICU team was either led by an ICU attending familiar with the hospital system or a hospitalist familiar with the hospital system paired with an agency or volunteer intensivist.

Schedules To Ensure Time Off and Backup Pools for Illness

Across sites, the increased volume of high-acuity patients placed a heavy emotional burden on frontline clinicians. To ensure time off to decompress, each site made adjustments to its standard schedules for the faculty. For example, NYU-Tisch moved from a 7-days-on/7-days-off model to working only 3 or 4 consecutive days at a time. At BH, attendings worked 6 days a week with 1 full week off out of every 4 weeks. Each site also created backup pools for clinician illness so that coverage was easily arranged when someone was out sick with Covid-19 or needed time off because of burnout or other illness. The residents' schedules were in 5-week blocks, which initially comprised 2 clinical weeks (6 days a week), 1 sick-call week, 1 backup sick-call week, and 1 learning plan week during which they participated in didactics and self-directed learning from home. This schedule proved to have insufficient time off because of significant utilization of sick call both for surge staffing and illness; the residents' schedules were ultimately adapted to 2 clinical weeks, 1 sick-call week, and 2 learning plan weeks to include more protected time off.

> *"Across all sites, teams were constructed to ensure balance between level of expertise and knowledge of the system, given that many staff were working in clinical areas not in their regular scope of practice."*

In all four hospitals, the major limitation to unit expansion was not space, equipment, or physicians, but rather the availability of critical care nursing staff. In developing a model for expansion, it is crucial to recognize this need and establish an ongoing source of affiliated or voluntary nurses who can be employed as the clinical need grows. Alternatively, hospitals can develop training programs so medicine floor nurses can move to and from the ICU.

Overall, early identification of staffing pools — including backup for surge and illness, construction of teams on the basis of pairing of expertise and familiarity with the hospital system, and onboarding plans — were essential for preparedness. However, strategies of implementation varied depending on the hospital system. Additionally, sources of staffing pools may be different with the second wave because the entire country is now affected, and we all need to adapt and plan for this possibility and depend more on internal staffing resources.

Staffing: Role of Medical Students

Students train in each of our four hospitals throughout their medical education. To help with the surge of patients with Covid-19, approximately 50 senior medical students who had completed their coursework graduated early voluntarily and were accredited to work as residents.

As with many medical schools, we suspended clinical clerkships during the peak of the Covid-19 pandemic. Clerkship students instead served in roles that could be done virtually. Activities in this capacity included providing clinical updates to patients' families, researching clinical questions posed by the medical teams, and participating in Covid-19 clinical research. The model of virtual team members is another method for expanding staffing pools with clinicians who cannot be physically present in the hospital.

Source of Admissions and Triage

Given the unique role of each hospital within its own system, there was variability in source of admissions at each site. This presented different challenges and resulted in some uniform, innovative strategies. Of the four hospitals, NYU-Tisch was faced with the most patients with confirmed Covid-19, peaking at 30 new Covid-19–positive patients every hour. To assist in triaging this volume and allow for separate areas for patients without Covid-19, NYU-Tisch redesigned the ED, creating a designated respiratory evaluation area. This area was retrofitted to maintain negative pressure throughout. Subsequently, the entire ED was converted to negative pressure. Specific acute-care floors and Covid-19 ICUs were identified to receive these new Covid-19 admissions from the ED. If the patients with Covid-19 had stable oxygen requirements after 2 days, they were transferred to a different unit for the remainder of their hospitalization. However, if they continued to show signs of clinical deterioration, including high levels of supplemental oxygen, they remained in these initial units. This intricate triage model was efficient in preserving hospital beds for severely ill patients on units with the appropriate level of care. Additionally, those patients who were initially triaged to a medicine unit and became critically ill were transferred to one of the designated Covid-19 ICUs.

NYU-Brooklyn, situated in the densely populated Sunset Park neighborhood in Brooklyn, received its admission base via the ED. The hospital also remained open as a referral center for acute strokes, ST-elevation myocardial infarctions, and neurovascular interventions. To separate patients with respiratory symptoms from patients with other complaints and to separate the severely ill from those with milder symptoms, the hospital set up an early triage system upon entry to the ED. Patients with milder respiratory symptoms were triaged to a negative pressure respiratory screening center, which saw a peak of 170-plus patients per day presenting with a respiratory illness, the majority of whom tested positive for Covid-19. Sicker patients with respiratory complaints were triaged to a negative pressure area of the ED, and those without respiratory complaints were grouped in a different area of the ED.

> *"In all four hospitals, the major limitation to unit expansion was not space, equipment, or physicians, but rather the availability of critical care nursing staff."*

BH, in contrast, had fewer direct admissions than did NYU-Tisch and NYU-Brooklyn and therefore had the capacity to accept a high volume of patients from the other acute-care facilities in the NYC Health + Hospital system that had had higher volumes of Covid-19 hospitalizations.[7] During the 6-

week peak of the pandemic in NYC, BH received 600 transfers from other NYC Health + Hospitals. The coordination of these transfers occurred through the NYC Health + Hospitals central office. Census data from the 11 acute-care hospitals in the system were reviewed daily, and with the involvement of the 11 chief medical officers of each of the hospitals, patients were identified for transfer and handoffs given electronically. Triage of all patients admitted to BH, including these outside hospital transfers, occurred centrally through the ED, which was separated into respiratory and nonrespiratory units.

Within the two-hospital system of the VA, its Brooklyn site was initially identified as the Covid-19 hospital. This allowed the VA's Manhattan hospital to treat solely non–Covid-19 admissions. The Brooklyn ICU quickly reached maximum capacity, however, and so a hybrid model was established at the Manhattan VA, admitting patients with and without Covid-19. Additionally, given the number of overwhelmed hospital systems in NYC, national leadership at the U.S. Department of Veterans Affairs enacted its Fourth Mission, which allowed for humanitarian care of nonveterans, first from the NYC Health + Hospitals network and subsequently from all hospitals in the New York region.[23] Local agencies, including NYC Health + Hospitals and the Greater New York Hospital Association, met daily with a dedicated VA transfer coordinator to make decisions on number of transfers based on the capacity of other hospitals and the VA's bed availability. The VA transfer coordinator then communicated directly with the VA ED and admitting staff about these transfers. The assessment and triage of these patients on arrival occurred in the ED. The total number of nonveteran cases (more than 110) represented almost one third of all Covid-19 admissions to the VA during this pandemic.

In a pandemic, tertiary- and quaternary-care referral hospitals can expect to be a central resource for system expansion. Smaller hospitals are likely to become overwhelmed and, with less space and fewer resources, may turn to these centers for assistance with overflow. Therefore, these tertiary and quaternary sites need to develop transfer and expansion protocols to care for these patients. All hospitals also need to prepare for triage of patients within their EDs and should consider respiratory and nonrespiratory areas.

Treatment Protocols and Clinical Practices

Given the limited evidence on the clinical management of Covid-19, sharing local best practices across sites was essential to providing high-quality care and to planning for resource shortages.[12] BH is a designated special pathogens facility for which the purpose is to enhance the level of preparedness across the United States for patients with highly pathogenic infections. Given this expertise, at the onset of the pandemic in NYC, leaders at BH shared their clinical experiences of special pathogens with colleagues across NYU. NYU-Tisch and NYU-Brooklyn led the way in the development of several clinical guidelines specific to the treatment of Covid-19, such as the management of hypoxia and the approach to anticoagulation. Other sites adapted these guidelines, adjusting for system-specific nuances such as formulary medications, in addition to generating their own site-specific protocols. The shared departmental structure across sites allowed for daily specialty-specific briefings (particularly in infectious diseases, pulmonary, cardiology, and nephrology) to ensure the rapid dissemination of protocols. Residents, who rotated among sites, also facilitated in sharing of best clinical practices. Finally, the four hospitals were enrolled in

clinical trials together as NYU-affiliated hospitals, which was important in obtaining complex therapies for critically ill patients across sites. There were several challenging aspects of clinical care on which the four sites were able to collaborate to develop innovative solutions, highlighted below.

Management of Respiratory Failure

Respiratory failure requiring mechanical ventilation is a common complication of Covid-19, and anticipatory planning for ventilator needs is vital.[24] All four hospitals closely tracked ventilator use, with daily assessments of ventilator counts and distribution according to clinical need. A ventilator allocation process was developed at each of our sites and modeled on the ventilator allocation guidelines developed (pre–Covid-19) by the New York State Department of Health in collaboration with the New York State Task Force on Life and the Law.[25] Fortunately, the steps taken to expand supplies and maximize the use of that supply prevented the need for ventilator allocation. More specifically, the allocation process included plans that: (1) set thresholds for use of noninvasive ventilation to preserve ICU ventilators; (2) promoted adaptation of noninvasive ventilators for invasive use; and (3) identified patients who were candidates for downgrade to alternative ventilators so that ICU ventilators could be put back into circulation for new acute presentations.

> *"None of the hospitals ran out of ventilators. However, more so than ventilators themselves, the disposable components, such as ventilator circuits and expiratory filters, represented a threatened resource at all four sites."*

Being part of larger public and federal health care systems, BH and VA had similar centralized ventilator deployment processes within the NYC Health + Hospitals and the VISN2, respectively. At BH, there was centralized management of ventilators through the NYC Health + Hospitals system with the Department of Strategic Sourcing working directly with vendors, donors, state officials, and federal officials to procure ventilators. Each of the 11 acute-care sites of NYC Health + Hospitals reported daily on ventilator supplies, including numbers in use and on standby and type of ventilator. This allowed for a transparent system for ventilator distribution. On the basis of prediction models, severe ventilator shortages were anticipated within the VA system. In response, the Deputy Under Secretary for Health for Operations and Management instructed the VISN2 directors to identify potential supply gaps for mechanical ventilation needs. VISN2 directors were advised to validate ventilator counts and to update their equipment-management databases. On the basis of these centralized data, ventilators were redistributed. The Manhattan VA demand exceeded its own supply but was able to obtain sufficient numbers of ventilators from other VA facilities within its VISN2.

With the above systems in place, none of the hospitals ran out of ventilators. However, more so than ventilators themselves, the disposable components, such as ventilator circuits and expiratory filters, represented a threatened resource at all four sites. Interhospital communication allowed for these supplies to be distributed among the four NYU hospitals to meet urgent needs while additional supplies were obtained.

Management of Renal Failure

Many patients with Covid-19 also experience acute renal failure requiring immediate treatment, which can overwhelm hospital resources.[24,26-28] All four sites were similarly challenged by the demand for renal replacement therapy. Nephrologists across sites collaborated on a uniform approach to handle renal replacement therapy. This approach included initiating a peritoneal dialysis program at each site and developing treatment protocols for continuous venovenous hemofiltration, reserving this modality of renal replacement therapy to hemodynamically unstable critically ill patients.

Additional strategies for optimizing dialysis resources at BH included gathering known Covid-19–positive patients on chronic dialysis in two-bed rooms to optimize nursing staff for bedside dialysis. The nephrology team at the VA adjusted the schedules of patients on chronic dialysis, when clinically appropriate, from three times a week to twice a week or shortened dialysis session duration to accommodate a larger number of patients. Additionally, the VA used newer portable all-in-one hemodialysis machines with ease of use that allowed for renal replacement therapy outside of the ICU. In addition, the greater VA network was called upon to provide existing supplies from less affected areas of the country as well as to send nephrologists to augment staffing with the increased volume of renal replacement therapy.

At all four sites, peritoneal dialysis ultimately provided a solution to expand renal replacement therapy capacity, as the procedure required fewer supplies and could be performed by trained in-house clinicians.

End-of-Life Care and Use of Rapid Response and Code Teams

All four sites saw an increase in rapid responses and codes and required strategies to safely meet these demands. The palliative care services at all hospitals worked proactively to discuss prognosis and outcomes with patients and their families. Proactive daily discussions, particularly in the ICUs, helped prevent decisions being made during the moment of decompensation.

At all four sites, it was essential to establish clear roles for rapid response and code team providers with principles of minimizing unnecessary entrance in patient rooms and ensuring adequate PPE. NYU-Tisch, NYU-Brooklyn, and BH all created Covid-19–specific rapid response and code teams. These teams were composed of hospitalist, critical care, surgery, and anesthesia attendings, in addition to nurses and respiratory therapists. As demand grew, the team was expanded to include residents at some sites. NYU-Brooklyn added a layer of proactive rounding to these teams, by which patients with high oxygen requirements were rounded on by the rapid response teams in addition to their usual care teams. At NYU-Tisch, an analytic tool to predict decompensation within 96 hours was developed to help target proactive rounding. Alternatively, the presence of patients with and without Covid-19 at the VA limited the ability to create a disease-specific team, but similar protocols were in place regarding roles and responsibilities and PPE.

Because hospitals are now encountering the first wave or preparing for the second wave, it is important to collaborate not just within affiliated hospital systems but more globally on

development of treatment guidelines as we all learn more about how to treat this disease. Additionally, we all will be similarly challenged by renal replacement therapy, management of respiratory failure and ventilators, and end-of-life care and code teams; hospitals need to have protocols in place for these domains of clinical care.

Staff Wellness

The Covid-19 pandemic has presented an unprecedented challenge to all health care workers, and efforts to promote wellness have been essential to help endure this challenge.[12,15,18] In addition to treating a vast number of critically ill patients, many workers chose to separate from their families and friends for prolonged periods of time to minimize the risk of infectious spread. Additionally, given visitor restrictions, providers were often the sole support system for patients. For these reasons and more, staff wellness was an ongoing concern and priority.

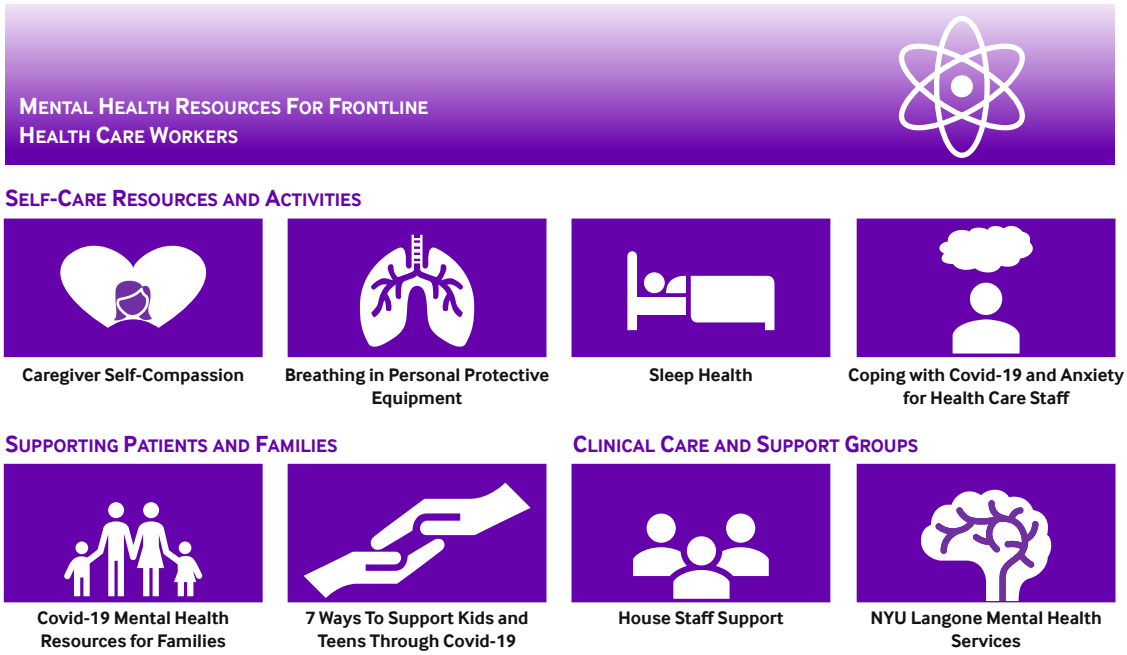
> *"The effects of this pandemic on the staff's mental health will continue far beyond the discharge of the last patient with Covid-19; therefore, these strategies to promote wellness will remain as long as the need persists."*

Because many staff were expected to take on additional hospital shifts to care for the immense number of patients, we created schedules with built-in time off to allow staff to recharge, as has been detailed above. Telehealth wellness visits were readily available for all frontline staff, with availability of evening hours to ensure sufficient access. Each site organized small-group discussions and debriefing sessions with all staff to promote ongoing conversations among employees at all levels. There were also group-specific debriefing sessions (e.g., for residents, faculty, or nursing) so discussions could occur within peer groups. Coping cards were distributed to staff; the cards featured information about skills that could be used in real time including techniques for minimizing stress, statements of self-appreciation, and activities for 1-minute mini-breaks to recharge. Wellness programs were provided to all NYU employees through an interactive webpage specifically created in light of Covid-19 (Figure 4).[29]

FIGURE 4

NYU Langone Mental Health Resources

In response to the Covid-19 pandemic, the NYU Department of Psychiatry developed mental health resources for frontline health care workers at all affiliated hospitals, adding to some existing resources, and easily accessed via an internal website.



Source: NYU Department of Psychiatry. Accessed September 2, 2020.

Among the resources included were meditation training, virtual yoga, breathing exercises created for use while wearing PPE, and guides for positive sleeping patterns. Additionally, resources were available for staff with families, including strategies for supporting children through the Covid-19 pandemic and how best to communicate with them about Covid-19 and how to manage reactions on the basis of developmental stage. Lastly, the philanthropic arm of NYU developed a central fund for assistance available to all NYU staff and NYU-affiliated physicians, regardless of their primary institution. This fund provided financial assistance for transportation to avoid public transportation, housing for those who wished to isolate from their families, and financial assistance for workers whose partners had been furloughed or lost their jobs.

We have seen an overall decrease in need for most of these resources now that Covid-19 rates are low and hospital volumes have returned to normal in NYC. Unfortunately, however, the effects of this pandemic on the staff's mental health will continue far beyond the discharge of the last patient with Covid-19; therefore, these strategies to promote wellness will remain as long as the need persists.

Looking Forward

As NYC became the epicenter for the Covid-19 pandemic, the hospitals of the Department of Medicine at NYU — BH, NYU-Tisch, NYU-Brooklyn, and the VA — developed multiple strategies for communication, surge capacity, clinical guidelines, and staff wellness. Despite these four hospitals being distinct, there were many uniform approaches that can be adapted by hospitals of any affiliation or size. Collaboration within academic affiliations and, more globally, across the country will be beneficial to leadership, staff, and patients. This overview can be used for diverse hospital systems that are currently facing, or are likely to experience, a surge of patients with Covid-19 or future disaster planning of any kind.

Verity E. Schaye, MD, MHPE
Director of Inpatient Medicine, NYC Health + Hospitals/Bellevue, New York, New York, USA

Assistant Professor, NYU Grossman School of Medicine, Division of General Internal Medicine and Clinical Innovation, New York, New York, USA

Jenna A. Reich
Medical Student, NYU Grossnman School of Medicine, New York, New York, USA

Brian P. Bosworth, MD
Chief of Medicine, NYU Langone Medical Center, New York, New York, USA

Professor of Medicine, NYU Grossman School of Medicine, Division of Gastroenterology, New York, New York, USA

David T. Stern, MD, PhD
Chief of Medicine, Veterans Affairs New York Harbor Healthcare, New York, New York, USA

Vice Chair of Education, NYU Grossman School of Medicine, Division of General Internal Medicine and Clinical Innovation, New York, New York, USA

Frank Volpicelli, MD
Chief of Medicine and Associate Chief Medical Officer, NYU Langone Hospital Brooklyn, Brooklyn, New York, USA

Assistant Professor, NYU Grossman School of Medicine, Division of General Internal Medicine and Clinical Innovation, New York, New York, USA

Neil M. Shapiro, MD
Associate Chief of Medicine, Veterans Affairs New York Harbor Healthcare System, New York, New York, USA

Associate Professor, NYU Grossman School of Medicine, Division of General Internal Medicine and Clinical Innovation, New York, New York, USA

Kevin D. Hauck, MD
Associate Director Inpatient Medicine, NYU Langone Health, New York, New York, USA

Assistant Professor, NYU Grossman School of Medicine, Division of General Internal Medicine and Clinical Innovation, New York, New York, USA

Ian M. Fagan, MD
Associate Director of Inpatient Medicine, NYC Health + Hospitals/Bellevue, New York, New York, USA

Assistant Professor, NYU Grossman School of Medicine, Division of General Internal Medicine and Clinical Innovation, New York, New York, USA

Seagram M. Villagomez, MD
Chief of Hospital Medicine, Veterans Affairs New York Harbor Healthcare System, New York, New York, USA

Assistant Professor, NYU Grossman School of Medicine, Division of General Internal Medicine and Clinical Innovation, New York, New York, USA

Amit Uppal, MD
Director of Critical Care, NYC Health + Hospitals/Bellevue, New York, New York, USA

Assistant Professor, NYU Grossman School of Medicine, Division of Pulmonary, Critical Care, and Sleep Medicine, New York, New York, USA

Harald Sauthoff, MD
Director, Medical Intensive Care Unit, Veterans Affairs New York Harbor Healthcare System, New York, New York, USA

Associate Professor, NYU Grossman School of Medicine, Division of Pulmonary, Critical Care, and Sleep Medicine, New York, New York, USA

Michael LoCurcio, MD, FACP
Associate Professor, NYC Health + Hospitals/Bellevue, New York, New York, USA

Associate Chair for Education, NYU Grossman School of Medicine, Division of General Internal Medicine and Clinical Innovation, New York, New York, USA

Patrick M. Cocks, MD
Director, Internal Medicine Residency Program, NYU Grossman School of Medicine, Division of General Internal Medicine and Clinical Innovation, New York, New York, USA

Douglas B. Bails, MD
Chief of Medicine, NYC Health + Hospitals/Bellevue, New York, New York, USA

Associate Professor, NYU Grossman School of Medicine, Division of General Internal Medicine and Clinical Innovation, New York, New York, USA

Disclosures: Verity E. Schaye, Jenna A. Reich, Brian P. Bosworth, David T. Stern, Frank Volpicelli, Neil M. Shapiro, Kevin D. Hauck, Ian M. Fagan, Seagram M. Villagomez, Amit Uppal, Harald Sauthoff, Michael LoCurcio, Patrick M. Cocks, and Douglas B. Bails have nothing to disclose.

References

1. Patel A, Jernigan DB; 2019-nCoV CDC Response Team. Initial public health response and interim clinical guidance for the 2019 novel coronavirus outbreak — United States, December 31, 2019 – February 4, 2020. MMWR Morb Mortal Wkly Rep 2020;69:140-6 https://doi.org/10.15585/mmwr.mm6905e1.

2. Liu Y, Gayle AA, Wilder-Smith A, Rocklöv J. The reproductive number of COVID-19 is higher compared to SARS coronavirus. J Travel Med. 2020;27:taaa021 https://academic.oup.com/jtm/article/27/2/taaa021/5735319 https://doi.org/10.1093/jtm/taaa021.

3. Murray CJL; IHME COVID-19 Health Service Utilization Forecasting Team. Forecasting COVID-19 impact on hospital bed-days, ICU-days, ventilator-days and deaths by US state in the next 4 months. medRxiv. March 30, 2020. Accessed May 5, 2020. https://doi.org/10.1101/2020.03.27.20043752.

4. Stier AJ, Berman MG, Bettencourt LMA. COVID-19 attack rate increases with city size. medRxiv. April 3, 2020. Accessed September 18, 2020. https://www.medrxiv.org/content/10.1101/2020.03.22.20041004v2 https://doi.org/10.1101/2020.03.22.20041004.

5. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. Acta Biomed 2020;91:157-60 https://www.mattioli1885journals.com/index.php/actabiomedica/article/view/9397 https://doi.org/10.23750/abm.v91i1.9397.

6. John Hopkins University & Medicine. COVID-19 United States cases by country map. Johns Hopkins Coronavirus Resource Center. Updated May 4, 2020. Accessed May 5, 2020. https://coronavirus.jhu.edu/us-map.

7. NYC Health. COVID-19: data. The Official Website of the City of New York. Updated May 3, 2020. Accessed July 27, 2020. https://www1.nyc.gov/site/doh/covid/covid-19-data.page.

8. Centers for Disease Control and Prevention. CDC COVID data tracker. United States COVID-19 cases and deaths by state. Updated September 17, 2020. Accessed May 5, 2020. https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html.

9. Centers for Disease Control and Prevention. Comprehensive hospital preparedness checklist for coronavirus disease 2019 (COVID-19). Updated March 24, 2020. Accessed May 5, 2020. https://www.cdc.gov/coronavirus/2019-ncov/downloads/HCW_Checklist_508.pdf.

10. Jenkins A, Ratner L, Caldwell A, Sharma N, Uluer A, White C. Children's hospitals caring for adults during a pandemic: Pragmatic considerations and approaches. J Hosp Med 2020;15:311-3 https://www.journalofhospitalmedicine.com/jhospmed/article/220705/hospital-medicine/childrens-hospitals-caring-adults-during-pandemic https://doi.org/10.12788/jhm.3432.

11. Meier KA, Jerardi KE, Statile AM, Shah SS. Pediatric hospital medicine management, staffing, and well-being in the face of COVID-19. J Hosp Med 2020;15:308-10 https://www.journalofhospitalmedicine.com/jhospmed/article/220762/hospital-medicine/pediatric-hospital-medicine-management-staffing-and-well https://doi.org/10.12788/jhm.3435.

12. Herrera V, Finkler N, Vincent J. Innovation and transformation in the response to Covid-19: seven areas where clinicians need to lead. NEJM Catalyst. April 16, 2020. Accessed September 18, 2020. https://catalyst.nejm.org/doi/full/10.1056/CAT.20.0087.

13. Cleveland Clinic Consult QD. How we created a hospital for COVID-19 patients in less than a month. Updated April 15, 2020. Accessed May 5, 2020. https://consultqd.clevelandclinic.org/how-we-created-a-hospital-for-covid-19-patients-in-less-than-a-month/.

14. Weissman GE, Crane-Droesch A, Chivers C, et al. Locally informed simulation to predict hospital capacity needs during the COVID-19 pandemic. Ann Intern Med 2020;173:21-8 https://www.acpjournals.org/doi/10.7326/M20-1260 https://doi.org/10.7326/M20-1260.

15. Kim M, Rabinowitz L, Nagula S. A primer for clinician development to the medicine floors from an epicenter of Covid-19. NEJM Catalyst. May 4, 2020. Accessed September 18, 2020. https://catalyst.nejm.org/doi/full/10.1056/CAT.20.0180.

16. NEJM Catalyst. What health care leaders and clinicians say about the Covid-19 pandemic. NEJM Catalyst. April 23, 2020. Accessed September 18, 2020. https://catalyst.nejm.org/doi/full/10.1056/CAT.20.0177.

17. Shah SS, Kulkarni N, Mahant S. Rapid publication, knowledge sharing, and our responsibility during the COVID-19 pandemic. J Hosp Med 2020;15:261 https://www.journalofhospitalmedicine.com/jhospmed/article/221389/hospital-medicine/rapid-publication-knowledge-sharing-and-our-responsibility https://doi.org/10.12788/jhm.3441.

18. Garg M, Wray CM. Hospital medicine management in the time of COVID-19: Preparing for a sprint and a marathon. J Hosp Med 2020;15:305-7 https://www.journalofhospitalmedicine.com/jhospmed/article/220371/hospital-medicine/hospital-medicine-management-time-covid-19-preparing?channel=28090.

19. Argenti PA. Crisis communication: lessons from 9/11. Harvard Business Review. December 2002. Accessed September 5, 2020. https://hbr.org/2002/12/crisis-communication-lessons-from-911.

20. Argenti PA. Communicating through the coronavirus crisis. Harvard Business Review. March 13, 2020. Accessed September 5, 2020. https://hbr.org/2020/03/communicating-through-the-coronavirus-crisis.

21. Arabi YM, Murthy S, Webb S. COVID-19: A novel coronavirus and a novel challenge for critical care [published correction appears in Intens Care Med 2020;46:1087-8]. Intens Care Med 2020;46:833-6 https://link.springer.com/article/10.1007/s00134-020-05955-1 https://doi.org/10.1007/s00134-020-05955-1.

22. Giannakeas V, Bhatia D, Warkentin MT, Bogoch II, Stall NM. Estimating the maximum capacity of COVID-19 cases manageable per day given a health care system's constrained resources. Ann Intern Med 2020;173:407-10 https://www.acpjournals.org/doi/10.7326/M20-1169 https://doi.org/10.7326/M20-1169.

23. U.S. Department of Veterans Affairs. About VA: mission statement. Updated April 8, 2020. Accessed May 7, 2020. https://www.va.gov/about_va/.

24. Richardson S, Hirsch JS, Narasimhan M, et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area [published correction appears in JAMA 2020;323:2098]. JAMA 2020;323:2052-9 https://jamanetwork.com/journals/jama/fullarticle/2765184 https://doi.org/10.1001/jama.2020.6775.

25. New York State Task Force on Life and the Law, New York State Department of Health. Ventilator allocation guidelines. November 2015. Accessed July 27, 2020. https://www.health.ny.gov/regulations/task_force/reports_publications/docs/ventilator_guidelines.pdf.

26. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study. Lancet 2020;395:507-13 https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30211-7/fulltext https://doi.org/10.1016/S0140-6736(20)30211-7.

27. Burgner A, Ikizler TA, Dwyer JP. COVID-19 and the inpatient dialysis unit: managing resources during contingency planning pre-crisis. Clin J Am Soc Nephrol 2020;15:720-2 https://cjasn.asnjournals.org/content/15/5/720 https://doi.org/10.2215/CJN.03750320.

28. Klok FA, Kruip MJHA, van der Meer NJM, et al. Incidence of thrombotic complications in critically ill ICU patients with COVID-19. Thromb Res 2020;191:145-7 https://www.thrombosisresearch.com/article/S0049-3848(20)30120-1/fulltext https://doi.org/10.1016/j.thromres.2020.04.013.

29. Spray AM, Patel NA, Sood A, et al. Development of wellness programs during the COVID-19 pandemic response. Psychiatr Ann 2020;50:289-94 https://search.proquest.com/openview/0b9bbdfdb14b099e1511d56d0d8e8f45/1?pq-origsite=gscholar&cbl=34519 https://doi.org/10.3928/00485713-20200613-01.