




# Rethinking the Drug Distribution and Medication Management Model: How a New York City Hospital Pharmacy Department Responded to COVID-19

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## Abstract

Beginning in March 2020, New York City began the fight against coronavirus disease 2019. Health care workers were faced with a disease that led to significant morbidity and mortality with no proven therapies. As hospitals became inundated with patients and underwent rapid expansion of capacity, resources such as drugs, protective and medical equipment, and hospital staff became limited. Pharmacists played a critical role in the management of clinical care and drug delivery during the pandemic. As members of the department of pharmacy within New York-Presbyterian Hospital, we describe our experiences and processes to overcome challenges faced during the pandemic. Strict inventory management through the use of daily usage reports, frequent communication, and minimization of waste was critical for the management of drug shortages. The creation of guidelines, protocols, and restrictions were not only used to mitigate drug shortages, but also helped educate health care providers and guided medication use. Managing technology through setting up new automatic dispensing cabinets to address hospital expansions and modifying the electronic order entry system to include new protocols and drug shortage information were also vital. Additional key pharmacist functions included provision of investigational drug service support and training of pharmacists, prescribers, nurses, and respiratory therapists to educate and standardize medication use. Through implementation of operational and clinical processes, pharmacists managed critical drug inventory and guided patient treatment. As the pandemic continues, pharmacists will remain vital members of the multidisciplinary team dedicated to the fight against the virus.

**KEYWORDS**

clinical pharmacy services, coronavirus, hospital pharmacy service

The first case of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in New York City (NYC) was reported on February 29, 2020.<sup>1</sup> On March 11, 2020 NYC experienced its first fatality, a number that steadily increased through April resulting in over 23 000 deaths.<sup>1</sup> The number of patients with coronavirus disease 2019 (COVID-19) requiring hospitalization reached over 52 000 in NYC in the months of March through May.<sup>1</sup> As such, many of these patients required intensive care unit (ICU) level care and mechanical ventilation (MV).<sup>2-5</sup>

NewYork-Presbyterian Hospital (NYPH) is comprised seven hospitals with over 2800 licensed beds including 400 ICU beds, across Manhattan, The Bronx, and Westchester. Within NYPH there are 43 clinical pharmacists and 13 pharmacy residents. During the first month of the city's outbreak, NYPH experienced up to a 120% increase in ICU beds.<sup>2</sup> Fueled by the dramatic increase in critically ill patients with COVID-19, pharmacists of all training levels embraced the responsibility to optimize medication therapy in collaboration with members of the health care team. As the number of ICU beds expanded beyond the walls of established ICUs into emergency rooms, operating rooms, procedural areas, and general floors, rapid changes in pharmacy operations and medication use processes ensued. Each site within the health-system needed to rapidly and strategically adopt changes to automation and technology, inventory management, investigational drug services, and workforce to maintain a high level of care during the pandemic. While inpatient admissions increased, maintaining optimal patient care and safety with limited resources became a challenge. This paper describes how pharmacists within NYPH responded to this momentous event in history by rethinking and reimagining pharmacy operations and medication management while balancing wellness during the pandemic (Table 1).

## 1 | DRUG SHORTAGES AND INVENTORY MANAGEMENT

The pharmacy department navigated drug shortages by having clear communication, direction, and a multidisciplinary approach.<sup>6</sup> The Drug Shortage Committee (DSC) at NYPH has representation from clinical and operational pharmacy, drug purchasing, information technology, and emergency medical services. The goals of this committee are to discuss pertinent shortages, assess the current inventory and usage, develop strategies to acquire and allocate supply, determine alternatives, and implement technology changes when necessary. During the pandemic, the DSC held meetings daily and created inventory reports of critical medications commonly used for treating patients with COVID-19. These reports were invaluable, and assisted pharmacy managers in trending supplies and proactively managing inventory in a rapidly changing environment.

The numerous drug shortages coupled with increases in admitted patients required changes to the inventory management process. The procurement team exhausted all purchasing possibilities for commercially available products, including direct ordering from pharmaceutical companies. To navigate the complexities of a large health-system in a densely populated city, the pharmacy department implemented several strategies. First, we consolidated the bulk ordering for crucial items to two hospitals to reduce delivery time from the vendor. We also centralized stock of commonly used medications and those on national shortage. Inventory management was also essential for cardiac arrest trays, given the higher demand. Operational managers implemented a defined schedule for replenishment in order to prepare adequate supply for patient care units. Additionally, virtual cardiac arrest kits were loaded in the automated dispensing cabinets (ADC) to reduce workload needed to replenish and replace the physical carts once accessed. Although meticulous inventory and drug procurement strategies provided some relief to combat shortages of critical medications, the expanded hospital census created additional demands. The pharmacy department implemented additional measures to facilitate drug conservation, including minimization of waste, restrictions, evaluation of beyond-use dating for sterile products, and preparation of more concentrated products.

We created drug consumption calculators to evaluate trends in medication use and determine necessary quantities to meet demand. Since this time, organizations have published COVID-19 drug calculators that may help estimate the needs of select medications based on the capability and capacity of a hospital during surge situations.<sup>7,8</sup> Additionally, we evaluated essential intravenous (IV) medications used during the pandemic to compound into either larger product sizes or higher concentrations to enable longer administration time.<sup>9</sup> Products evaluated included midazolam, dexmedetomidine, fentanyl, hydro-morphone, cisatracurium, rocuronium, norepinephrine, vasopressin, epinephrine, and phenylephrine. Beyond-use dating was implemented per United States Pharmacopeia guidelines and regulations.<sup>10</sup> Not only did these strategies allow for reduced waste, but they also eased the pharmacy compounding workload and nursing burden of entering patient rooms frequently to change IV bags.

At the peak of the pandemic, several medications required tighter inventory control and therefore required an approval to authorize use and, in some cases, were treated as controlled substances. This inherently created significant strain on providers, pharmacists, and approval sources, but was a crucial measure to conserve limited supplies. Restrictions placed on hydroxychloroquine, azithromycin, tocilizumab, and albuterol metered-dose inhaler permitted a crosscheck system that ensured appropriate use of medications for patients with COVID-19. As inventories changed on a daily basis, pharmacy management regularly modified restriction criteria in order to maximize conservation while minimizing unnecessary additional workload of the health care team.

**TABLE 1** Pharmacy tasks completed to accommodate COVID-19 pandemic

	Task
Workforce management	Restructure clinical coverage to accommodate expanded patient capacity (establish a balanced and feasible quantity of patients per clinical specialist)
	Evaluate opportunities to promote social distancing practices and necessary equipment/workflow changes (ie, remote order verification, consolidated work weeks)
	Establish a schedule and buddy system for remote pharmacy coverage
	Develop plan to determine remote practice productivity
	Identify practice changes to conserve personal protective equipment
	Identify and development of guidelines specific to pandemic needs
	Develop and implement COVID-19-related guidelines
	Develop a plan to train staff pharmacists for new disease states and therapy management (ie, ICU management); assess staff comfort levels through routine communication and training
Automation and technology	Establish line of communication to hospital command center
	Assess automated dispensing cabinets and determine available equipment that can be obtained and deployed for new patient unit conversions
	Develop medication lists essential for population of patient care areas
	Complete walkthrough of space to determine limitations of facilities including data, power, and space
	Determine plan to assess dispensing data to optimize pars and shelf space, as appropriate
	Evaluate functionality of automated dispensing cabinets to maximize space, such as use of virtual kits
	Complete validation of existing workflows after new patient care area go-live: dispense logic, override lists, pump builds and medications ordering restrictions
Inventory management	Evaluate channels for drug purchasing and establish streamlined approach
	Develop medication lists requiring compounding that are essential for population in patient care areas
	Determine plan to assess dispensing data to understand new trends in usage and required quantities to meet demand (ie, compounding calculator)
	Evaluate current state to determine opportunities to maximize compounding practices (ie, beyond-use dates, compounding concentration)
	Enforce tight inventory management on critical medications for pandemic treatment
	Determine plan to track cardiac arrest tray usage to prepare adequate reserve to replenish used supply
	Leverage existing expert groups (ie, drug shortage committee, compounding oversight group) across the health-system to track inventory and determine necessary strategies
Investigational drug services	Establish pathway for expedited protocol review and fast track submission to institutional review board
	Develop plan to extend supporting hours to facilitate patient enrollment and medication preparation
	Leverage relationships with study teams to coordinate efforts, streamline protocol activations, and share workloads
	Create, validate, and activate entries in the electronic medical record
	Develop a centralized model at de novo sites to streamline education and training efforts
Wellness	Encourage staff to make use of hospital resources for coping with anxiety, increased workload, work-life balance, and social isolation
	Attend meetings to keep up to date with information disseminated by the department and hospital
	Use personal/vacation time when possible

Abbreviations: COVID-19, coronavirus disease 2019; ICU, intensive care unit.

Shortages of frequently used IV medications for critically ill patients such as opioids, sedatives, and neuromuscular blocking agents (NMBA) were significant given the number of mechanically ventilated patients with severe acute respiratory distress syndrome (ARDS) requiring deep levels of sedation, chemical paralysis, and prone positioning. Shortages for dexmedetomidine and propofol forced clinicians to use non-preferred sedatives with prolonged durations of actions and active metabolites. The addition of oral opioids

and benzodiazepines became a necessity to initiate in the setting of severe shortages of IV agents. A comprehensive clinical guideline was rapidly developed by a multidisciplinary team lead by critical care pharmacists to assist in transitioning from continuous infusions to scheduled oral agents. Clinical pharmacists encouraged intermittent bolus doses of NMBA to conserve supplies. Additionally, when providers used NMBA as continuous infusions, titration parameters were fluid, often targeting the lowest dose to achieve ventilator synchrony

given the limited supply of peripheral nerve stimulators. A recent publication provides a summary of opioids and sedatives that may be used in patients with COVID-19 in the setting of shortages of first-line agents.<sup>11</sup>

With the increasing number of patients who developed acute kidney injury and required continuous renal replacement therapy, shortages of dialysate solutions called for prompt and innovative strategies. A multidisciplinary team of nephrologists and clinical and operational pharmacists implemented alternative plans, which included changing the duration of sessions from 24 to 12 hours. The nephrology team transitioned certain patients to peritoneal dialysis or intermittent hemodialysis as tolerated. Another complex contingency plan developed by the multidisciplinary team, but was not ultimately implemented, involved adapting the dialysis machine to produce machine-generated dialysate.<sup>12</sup>

Communication and education of drug shortages during the COVID-19 pandemic was critical to minimize delays in medication administration and ensure optimal patient care. As these shortages rapidly evolved, the department implemented real-time electronic communication to disseminate crucial information to providers, nurses, and members of the pharmacy department. Clinical pharmacists provided education during patient care rounds about drug shortages and therapeutic alternatives, as well as where to locate drug alert information electronically. The addition of critical shortage alerts to the electronic medical record (EMR) helped guide providers to the medications that were available. Frequent email correspondence ensured that pharmacists and providers were updated on newly reported drug shortages, current stock of medications, and alternative agents that could be used. Smaller hospitals without a similar infrastructure should develop a disaster plan based on available resources to ensure cost-effective solutions, establish routine team meetings to discuss challenges, and use listservs and contact colleagues who have experienced surges to gain insight and solutions in operational and practice gaps.

## 2 | DEVELOPMENT OF INSTITUTIONAL COVID-19 GUIDELINES

For clinical pharmacists, providing evidence-based recommendations is extensively woven into the fabric of our daily work; it is one of our defining features on medical teams. However, without prospective, randomized studies to guide therapy against SARS-CoV-2, we were struck with the dilemma of how to practice evidence-based medicine. Despite the lack of randomized, controlled trials, there were frequent publications stemming from a preprint server, medRxiv, that posted articles prior to peer review ranging from antiretrovirals (lopinavir/ritonavir), antibacterials (azithromycin), antiparasitic agents (ivermectin), and antimalarials (chloroquine and hydroxychloroquine) to immunomodulatory agents (anakinra and tocilizumab). Many of these studies had significant limitations such as small sample size, absence of a control group, and/or poor external validity. The first iteration of NYPH's COVID-19 guidance document was created prior to

publication of national guidelines.<sup>13-15</sup> In the absence of evidence and national guidelines, local conversations with scientists, physicians, and pharmacists from various disciplines turned more philosophical. Debates on "should investigational drugs be used to treat patients?" ensued as the search for the most optimal treatment for patients with COVID-19 continued.<sup>16</sup>

A small group of infectious diseases physicians and pharmacists evaluated new data as it became available, and larger interdisciplinary groups including hematologists, rheumatologists, critical care pharmacists, and physicians held video meetings to garner input and consensus. The guidance document was updated every 1 to 2 weeks. When reflecting upon our process, a few key tenants emerge. These include: having a small group serve as gatekeepers over the treatment document; staying abreast of literature and engaging others in journal clubs to assess strengths of recommendations coming from small, retrospective studies; coupling recommendations with clinical support from the EMR, including order sets, bundles, and restrictions; and updating and disseminating the guidance document frequently, and ensuring education to all health care providers.

The high volume of patients with COVID-19 required non-critical care trained prescribers, nurses, and pharmacists to assume primary care for a portion of these patients. In addition, it was paramount to the safety of the health care teams to limit exposure and conserve the use of personal protective equipment (PPE) as it related to medication administration. Multidisciplinary workgroups, including clinical pharmacists, rapidly created treatment guidelines to assist clinicians in the care of these patients (Table 2).

Very early on, a medication guideline was created, which encouraged bundling of medications by timing medication administration together with laboratory draws to minimize nurse entry into patients' rooms. Administration times were standardized whenever possible. For instance, pharmacists modified medications with the frequency of every 12 hours to have designated scheduled times of nine o'clock in the morning and evening. These medications typically included stress ulcer prophylaxis, venous thromboembolism prophylaxis, corticosteroids, chlorhexidine for oral care, and antimicrobial agents. Nurses also administered medications with once daily dosing at one of these designated administration times. The nurse administered one-time doses at the next time the nurse had to enter the room if not needed emergently. Medications that required more frequent administration, such as nebulizer treatments, were bundled with blood glucose checks or insulin nutritional and correctional scale regimens. For medications that required therapeutic drug monitoring, pharmacists and nurses coupled the timing of the level with other blood phlebotomy draws or when the nurse would be entering the patients' rooms for other reasons. Another implemented bundling method included decreasing the frequency of medications and minimizing medications that require frequent monitoring. Pharmacists switched bowel regimens, for instance, to once daily dosing and coupled with other medications to be administered during the standardized times. Lastly, as part of the bundling guideline, pharmacists changed enteral medications that require tube feeds to be held prior to and after administration to the IV route.

**TABLE 2** Summary of hospital guidelines created during COVID-19

Guidelines created	Specialties involved	Rationale for development	Major concepts
<b>Critical Care</b>			
Guidelines for Weaning and Incorporation of Enteral Administered Medications for Management of Sedation in Mechanically Ventilated Patients with COVID-19	Clinical Pharmacists Anesthesiologists Psychiatrists Critical Care Intensivists	Sedation in this population was often difficult to manage due to the complexity of the disease which included high ventilator settings and multi-organ failure, requiring prolonged and deep sedation. Guidelines were created as an educational aid and to optimize all aspects of sedation management.	Guidance on management of sedation in the setting of patient-ventilator dyssynchrony and neuromuscular blockade use was provided Enteral agents were recommended when possible in the setting of national shortages of intravenous analgesics and sedatives Additional recommendations for the management of pain, withdrawal, and delirium were outlined
Guidelines for the Use of Intravenous Sedatives and Opioids for Mechanically Ventilated Patients (not receiving ECMO) with COVID-19			
<b>Cardiology</b>			
Standard Operating Procedures for STEMI during COVID-19	Interventional cardiologists Clinical pharmacists Emergency medicine physician group	Due to the anticipation of resource scarcity, and increased exposure and use of personal protective equipment in the cath lab, fibrinolytic therapy was considered in the STEMI management algorithm. <sup>22</sup>	Tenecteplase was considered if a patient was confirmed positive or under investigation for COVID-19 presenting with a STEMI with onset of symptoms of <12 hours and no contraindications for lytic therapy Tenecteplase, P2Y12 inhibitors, and unfractionated heparin dosing was noted in the standard operating procedure
<b>Nephrology</b>			
Anticoagulation Guideline During CRRT COVID-19 Protocol for Recurrent Clotting Episodes in 24-hour Period	Nephrologists Clinical pharmacists Hematologists	Due to recurrent clotting episodes in a 24-hour period on CRRT, a guideline was created for modifying and escalating pharmacologic management in an attempt to reduce clot burden in the dialysis circuit.	Once vascular access was established, stepped therapy with citrate, partial or full dose unfractionated heparin, or argatroban based upon the patient-specific characteristics was recommended
<b>Hematology</b>			
Guidelines for the Diagnosis and Treatment of VTE in COVID-19 Patients	Hematologists Clinical pharmacists Cardiologists	COVID-19 might predispose patients to thrombotic disease through upregulation of the inflammatory cascade, platelet activation, and endothelial dysfunction. <sup>23</sup>	To minimize health care workers exposure, surrogate markers were used for the diagnosis of VTE in lieu of computerized tomography angiography or ventilation-perfusion scans A VTE treatment algorithm including recommendations for therapeutic anticoagulation, systemic thrombolysis, and catheter directed thrombolysis or embolectomy was developed
Guidelines for the Prophylaxis of VTE in COVID-19 Patients	Pulmonary/critical care intensivists		
<b>Endocrinology</b>			
Glycemic Control Guidelines - Critically Ill COVID-19 Patients	Clinical Pharmacists Endocrinologists	Critically ill patients often require insulin infusions to control hyperglycemia and to manage variable glucose levels. Use of insulin drips requires frequent glucose checks (every 1–2 hours). In order to limit nursing exposure and preserve PPE, a guideline was created to promote the safe and appropriate use of subcutaneous insulin.	Weight-based dosing recommendations for insulin glargine or insulin NPH as well as short acting standing nutritional insulin were included Specific criteria for patients who require continuous insulin infusion were developed. Note this guideline excluded patients with hyperglycemic crisis
<b>Infectious Diseases</b>			
How to Obtain Remdesivir for COVID-19 Patients Interim Working Guidance Document for Inpatient	Clinical pharmacists Infectious disease physicians	Guidelines were developed and the infectious disease team updated their guidance documents every 1–2 weeks as data was rapidly emerging regarding different	Anti-infective indications, dosing, and monitoring were provided Guidance was provided for the use of immunomodulatory agents in the setting of CRS

(Continues)

**TABLE 2** (Continued)

Guidelines created	Specialties involved	Rationale for development	Major concepts
Management: NYP Division of Infectious Diseases Clinical Practice Guideline for Assessment of IL-1 Blockade in COVID-19 Patients with Clinical and Laboratory Features of CRS		therapeutic strategies for the treatment of COVID-19 patients.	Inclusion and exclusion criteria for clinical trials evaluating investigational agents were delineated Criteria of use for remdesivir emergency use authorization and expanded access protocol were described

Abbreviations: COVID-19, coronavirus disease 2019; CRRT, continuous renal replacement therapy; CRS, cytokine release syndrome; ECMO, extracorporeal membrane oxygenation; NPH, neutral protamine Hagedorn; PPE, personal protective equipment; STEMI, ST-elevation myocardial infarction; VTE, venous thromboembolism.

The use of enoxaparin was favored for prophylaxis over the use of the more frequently dosed subcutaneous unfractionated heparin. When therapeutic anticoagulation was necessary, the guidelines recommended direct oral anticoagulants first-line if clinically appropriate to minimize monitoring requirements. If direct oral anticoagulants were not appropriate due to patient-specific characteristics, the guidelines recommended use of enoxaparin with anti-factor Xa monitoring over continuous infusion unfractionated heparin whenever possible.

As the pandemic has waned in the Northeast, our hospital aims to critically evaluate each of these guidelines. Each guideline will gain approval from a larger group across more disciplines and campuses to ensure there is broad consensus.

### 3 | AUTOMATION AND TECHNOLOGY

Optimizing the use of automation and technology was central to managing the patient influx. With limited new automated dispensing cabinets available and an increasing number of new patient care units and “field hospitals,” a plan to deploy equipment required strategic prioritization and optimization to ensure that sufficient medications were available to all areas. As new ADCs were acquired to fulfill the demand, rapid assembly and deployment of ADCs and associated dispensing logic was paramount. Critical attention to appropriate and adequate quantity of drugs to new ADCs was essential to provide seamless care. Depending on the placement of the ADC in relation to the acuity of the patients, operational pharmacists created medication lists for intensive care, general medicine, and palliative care units. However, structural and facility limitations often proved a challenge for nimble execution. Once notified of a potential new patient care area, walkthroughs were always completed to ensure there was adequate data cabling, power, and space for ADC placement. Most commonly, space was the rate-limiting factor, therefore an assessment was completed to determine if a smaller size ADC was available for use. In “field hospitals” with limited space, anesthesia workstations were repurposed for medication dispensing. When all three limitations existed, coordination with facilities and nursing was required to identify alternate locations. During implementation of new ADCs, the informatics team played a critical role in electronically building units or “field hospitals” and adjusting associated ordering restrictions in the EMR.

The pharmacy department made medication-specific changes to the EMR, such as medication builds for new products and alerts for restrictions/shortages in real time. For example, to assist prescribers, the information technology (IT) team changed infusion order panels within the EMR to default to the preferred bag or concentration size. The IT team also developed order sets within the EMR to help guide prescribing such as the case with albuterol nebulization vs metered-dose inhaler to assist with conservation and appropriate PPE considerations. Other order sets were developed to ensure the correct dose, frequency, and duration of a drug ordered, such as in the case of hydroxychloroquine.

### 4 | INVESTIGATIONAL DRUG SERVICE

The investigational drug service (IDS) pharmacy played an instrumental role in the successful provision of investigational therapies to a large cohort of COVID-19 patients. Many treatment options were under investigation during the initial COVID-19 surge, forcing expedited reviews of protocols by the investigational review board. The IDS operating hours were extended to include weekends and 24/7 on-call support to facilitate patient enrollment and dispenses. Coordinated efforts by the IDS staff and infectious diseases study teams helped streamline multiple, simultaneous protocol activations, consolidate dispensations, and share workload. Together, the IDS and IT teams created, validated, and activated drug entries for the EMR. The IDS pharmacy facilitated study activations at de novo sites by implementing a centralized model with intense on-site education and training to staff pharmacists focused on verification of patient enrollment and consent, drug accountability, and protocol-specific drug handling and dispensing. The IDS team routinely reassessed its operations and pivoted to meet the demands in a rapidly changing environment.

### 5 | WORKFORCE MANAGEMENT

The demand for pharmacists exceeded the supply during the COVID-19 pandemic, resulting in practice model changes affecting all employees within the Department of Pharmacy. Changes to both clinical and operational staffing models were quickly implemented to allow for safe and effective patient care.

Maintenance of pharmacy operations required a balancing act between upholding social distance practices for employees while ensuring adequate staffing to meet the patient volume. Distribution of hospital-issued laptops allowed for remote order verification. Work weeks were modified from five shorter days to four longer days to reduce the number of individuals working on-site per day as well as the number of days each individual would need to spend commuting. The pharmacy department developed a staffing contingency plan with a reserve workforce that included pharmacy managers and per diem pharmacists. To monitor productivity, operational managers tracked metrics, including number of orders verified, interventions, and the proportion of nursing messages completed. Responsibilities were recalibrated to maximize remote tasks while consolidating dispensing functions to those onsite. Lastly, the operational team managed staff comfort levels through frequent communication and training.

As hospitals expanded ICU beds, pharmacy administration anticipated a shortage of critical care pharmacists and employed a large-scale education effort to train general pharmacists in critical care. Critical care trained pharmacists quickly designed lectures and interactive discussions that were specific to caring for critically ill patients with COVID-19. The lectures included topics such as mechanical ventilation, sedation management, treatments used for the management of ARDS, vasoactive medications, and prophylaxis. These pharmacists delivered lectures live over videoconference and made slides available immediately afterwards. In addition, relevant reading material, such as hospital guidelines and book chapters were distributed. Pharmacy administration assigned each non-critical care clinical pharmacist to a critical care clinical pharmacist "buddy" to allow for informal, detailed questions to be addressed. To ensure all pharmacists were receiving up-to-date information, critical care clinical pharmacists held and lead twice-weekly videoconferences to discuss difficult cases and changes to treatment management. Time was also allotted for any other questions that needed further discussions.

Another temporary practice model change included redeploying postgraduate year one and two pharmacy residents into various roles to manage rapidly escalating clinical and operational demands. The critical care pharmacy residents were assigned to provide clinical coverage to a new ICU in the emergency department and to an ICU at one of the community hospitals within NYPH. The residents provided education to non-ICU practitioners and helped optimize medication use. Other residents were incorporated into a formalized schedule to assist with batching of IV medications and verifying orders in the setting of increased patient volume and staff shortages. At the onset of the pandemic, NYPH and pharmacy schools pulled pharmacy students from rotations in order to minimize contact and decrease exposure. However, providing clinical coverage even remotely during a pandemic would have been an invaluable experience for students who will soon be graduating and practicing on the front lines. In light of this missed educational opportunity, future students could be incorporated into the model to complete medication reconciliation or develop educational materials, but buy in from pharmacy schools would first be required.

The pandemic also resulted in a change from a direct patient care model to a partial remote work model. Since NYPH is located in NYC, it poses unique environmental risks, one of which is that 54% of health care workers depend on public transportation to commute to and from work.<sup>17</sup> Another risk is that office space is limited in many areas, which does not allow for proper social distancing. In order to help prevent the transmission of the virus to pharmacists, other health care professionals, and patients, the clinical pharmacy model was modified to require only 50% of the clinical pharmacists in each specialty to be onsite during normal business hours on a rotating schedule. The clinical pharmacists that were onsite continued to provide clinical pharmacy services by attending daily interdisciplinary rounds (in-person or virtually). Although working remotely is not optimal, this clinical pharmacy model allowed pharmacists to continue to provide patient care while reducing the risk of being infected or transmitting the virus to others.

## 6 | WELLNESS DURING COVID-19

Health care workers may be particularly vulnerable to psychosocial symptoms related to work conditions and feelings of fear and frustration. The rapid rise in the number of COVID-19 infections in certain areas of the United States, including NYC, led to a large influx of hospitalized patients that quickly overburdened health care systems. Staff shortages resulted in exhaustion from long work hours and hospital workers being put into uncomfortable positions caring for patients despite limited training. The fear of getting sick, infecting others, or being responsible for the death of others also increased the risk for anxiety and fear. Many health care workers caring for patients with COVID-19 chose to live apart from family members to decrease the risk of viral transmission, further worsening social isolation.<sup>18,19</sup>

Hospital systems must be mindful of the increased risk for mental health consequences of health care workers during this pandemic and, in turn, should be willing to change workflow or workload, modify guidelines to help facilitate a healthy work-life balance, provide access to counseling, psychologists/psychiatrists, regularly acknowledge and praise staff, ensure clear communication to workers, listen to ideas of others, and ensure that staff feel they are a priority. In late March, the World Health Organization published recommendations on mental and psychosocial health for the general population and for health care workers specifically.<sup>20</sup> Additionally, another NYC hospital system shared their institution's approach to promote emotional wellbeing for their workforce during the pandemic.<sup>21</sup>

NYPH implemented a number of practices and initiatives to help reduce stress, facilitate coping, and maintain engagement. Resources for parents such as online tutoring and childcare were available as daycares, schools, and after-school programs closed throughout the city. Employees received recognition bonuses and free meals and parking.

Free virtual urgent care services were available to allow hospital workers access to health care while outpatient clinics were closed.

Emotional wellbeing resources that included access to pastoral care, coaches, and mental health professionals, and online videos of support sessions, yoga, and meditation classes, and guidance documents were also available. Employees could also use “recharge rooms” to decompress during breaks or downtime at work.

Several resources were available to help with optimizing consistency and minimizing confusion and associated anxiety. Hospital leadership held virtual daily briefings that included updates about shortages, changes to hospital guidelines, operational decisions, and COVID-19 testing. Frequently asked questions were also addressed in these debriefings. Biweekly meetings held by pharmacy leadership provided an open forum for clinical and operational pharmacy teams to express any concerns, provide updates, and share experiences. A hotline staffed by the Workforce Health and Safety department who would answer questions about COVID-19 testing and related symptoms, refer for COVID-19 testing, and help provide medical clearance was also available to hospital workers.

## 7 | CONCLUSION

Despite the challenges and principles of humanism that health care workers faced, pharmacists were a fundamental component of the institution's efforts to combat the COVID-19 pandemic. We showed up, accommodated to new roles, were nimble with drug shortages, invested in continuity of care, and had to rethink practices. While our competency made us valuable, it reflexively made us vulnerable. We would often reflect on the day's work as cheers, banging of pots, and sirens were heard throughout the boroughs religiously at 7 PM as a tribute to front line workers. We were propelled to the next day with the comradery of our colleagues or a simple text of concern from friends or family. Our work, however, is not over. As NYC emerges from the surge, we must reconstruct practices, evaluate lessons learned, and prepare for the future.

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## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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