

Rising to the challenge: Pharmacy residents on the frontlines during COVID-19 pandemic

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Purpose. To provide pharmacy residents' perspective on how the department of pharmacy at a large academic medical center prepared and managed the surge in admissions of patients with coronavirus disease 2019 (COVID-19), to describe how residents were trained for intensive care unit (ICU) staffing, and to provide recommendations on how residency programs nationally could navigate a second wave of COVID-19 admissions or other disaster response situations.

Summary. The majority of postgraduate year 1 (PGY1) pharmacy residents at the institution were trained for ICU staffing and deployed throughout the hospital to ICU units converted to dedicated COVID-19 ICUs to assist in patient care. The training process included live videoconference lectures about relevant ICU topics and on-site experiences with critical care clinical pharmacists. Based on their experience in training for and participating in ICU care of patients with COVID-19, the pharmacy residents recommend considering additional cross-training of residents, integration of additional clinical education, creation of opportunities for resident involvement in telehealth, advancement of residents' roles in emergency responses, building robust mental health services, and continued advocacy for the advancement of pharmacists' and pharmacy residents' scope of practice.

Conclusion. The onset of the COVID-19 pandemic caused the institution to reevaluate the allocation of resources, and the department of pharmacy elected to deploy PGY1 pharmacy residents with previous ICU experience to assist in caring for an ICU patient census that had doubled. This experience will be valuable in preparing for another potential wave of COVID-19 cases and a surge in admissions of other groups of patients who deferred care due to the pandemic.

Keywords: COVID-19, pharmacy residency, SARS-CoV-2, disaster response

Boston, Massachusetts, was not immune to the devastation that the early weeks of the coronavirus disease 2019 (COVID-19) pandemic brought starting in early March 2020. As the pandemic began to unfold in New York, hospital and pharmacy administrators at our institution thought of how to best prepare the pharmacy department for the upcoming surge in cases of suspected or confirmed COVID-19. At Massachusetts General Hospital, a large academic medical center in Boston, there were 352 patients admitted with confirmed COVID-19 during the initial peak of the pandemic, the most admissions for COVID-19 at any hospital in the state. During normal operations, the hospital has 114 intensive care unit (ICU) beds, with an average census of 97 patients across 8 ICUs. The 8 ICU units were considered the institution's legacy ICU units. In the midst of the initial surge, there were 167 ICU patients who had tested positive for the COVID-19 virus in addition to patients receiving care for other reasons, bringing the total to 200 ICU patients, and there were 187 patients receiving mechanical ventilation (Figure 1). Four general care units were converted to ICU-level care (these were referred to as surge ICU units) to help account for the increased census, which had effectively doubled the number of ICU patients normally admitted to the hospital.

In the weeks leading up to the surge in patients, while nurses and physicians were being redeployed to the ICU units, the department of pharmacy was also called upon to meet the needs of a rapidly growing number of patients with COVID-19. The institution's pharmacy practice model is based on decentralized clinical pharmacist coverage, with ICU pharmacists' responsibilities including clinical rounding, drug information, and order verification services.

The department leadership ultimately decided that in order to clinically support the organization, pharmacy residents and non-ICU clinical pharmacists would be deployed to practice as critical care pharmacists in the designated COVID-19 ICUs. The purpose of this article is to provide a pharmacy resident perspective on how the department prepared and how residents were trained for work in the ICUs and to provide recommendations on how residency programs nationally could navigate similar situations in the event of a “second wave” of patients with COVID-19 or other disaster response situations.

Initial phases of response

While the hospital was beginning to admit the first few patients with confirmed or suspected COVID-19, the pharmacy residents continued serving their previously scheduled March rotations. By mid-March, work-from-home plans were quickly mobilized for any nonessential personnel throughout the institution and the department of pharmacy to ensure physical distancing for staff safety. These plans initially included all pharmacy residents, and all rotation activities were converted to virtual experiences, including remote online patient workups, videoconferencing-based clinical rounding, and virtual preceptor-resident topic discussions. Outside of rotations, residents were still expected to be in the hospital for decentralized weekend staffing and centralized weekday staffing. Pharmacy residents were also retrained in IV room compounding in order to prepare for potential shortages of technician resources due to concerns for staff quarantines and the increased utilization of IV medications throughout the hospital.

Despite this conversion to remote work, residents began to volunteer on an individual basis to participate in on-site ICU coverage, which included rounding with ICU patient care teams, serving as a resource for drug information on the ICU floor, therapeutic drug monitoring, and order verification. The residency program leadership saw that many of the residents desired to assist the overwhelmed ICU services and began accepting offers to move back on-site and into the COVID-19 ICU services. As numbers continued to climb and the need for frontline clinical pharmacists grew, all pharmacy residents with relevant ICU experience who had expressed a willingness to help in the event additional pharmacists were required were called upon to provide on-site ICU pharmacist care. Five of the 8 PGY1 residents were transitioned from their rotations to train in the ICU at different time points through the end of March and into April. The remaining 3 pharmacy residents participated in operational needs related to drug shortages or assisted with taking medication histories.

Preparation for ICU coverage

The critical care clinical pharmacists and director of graduate pharmacy education (DGPE) led departmentwide videoconferences throughout the end of March and the beginning of April in order to prepare clinical pharmacists and pharmacy residents for cross-coverage of ICU floors. Topics included mechanical ventilation, sedation and analgesia, weaning strategies, and neuromuscular blockade. Slides that were presented and any additional handouts prepared were distributed electronically to pharmacy staff for future reference. The DGPE also provided additional, ASHP-developed resources¹ to staff who wished to refamiliarize themselves with

critical care topics, such as the ASHP critical care review course that was available for no charge for a limited time.

The pharmacy residency leadership and clinical managers kept each individual resident's clinical interests and previous ICU rotation experiences in mind when selecting pharmacy residents to pull from rotation. Residents who had at least 1 previous ICU rotation experience were trained for placement in the newly established surge ICU units. However, if residents had 2 or more previous ICU rotation experiences, they were trained for potential placement in the surge ICUs or legacy ICUs with the most critically-ill patients.

The PGY1 residency program director (RPD) also worked to continue to promote resident evaluation by building a new rotation and syllabus for "COVID ICU Experience" within PharmAcademic (McCreadie Group, Ann Arbor, MI), the online evaluation tool used for pharmacy resident assessments. Objectives the pharmacy residents were evaluated on included the ability to collect information on which to base safe and effective medication therapy, the ability to analyze and assess information on which to base safe and effective medication therapy, and the ability to design or redesign safe and effective patient-centered therapeutic regimens and monitoring plans (care plans). This evaluation enabled residents who participated in COVID-19 ICU staffing to receive feedback from the critical care clinical pharmacists throughout the process.

PGY1 pharmacy residents at the institution are all trained in staffing medicine and surgical floors for their decentralized weekend staffing and are trained to participate in emergency response throughout the hospital during orientation. The week of ICU training was conducted within the legacy ICU units, which housed the highest-acuity patients requiring

advanced therapies like veno-arterial extracorporeal membrane oxygenation (VA-ECMO). Residents were paired with experienced critical care clinical pharmacists for varying durations, ranging from 1 week to a week and a half, to train during the evening shift. The critical care clinical pharmacists taught the pharmacy residents the rapidly changing policies, procedures, and clinical evidence surrounding optimal COVID-19 care. Pharmacy residents were responsible for answering drug information questions from the legacy ICUs, following up on any needed therapeutic drug monitoring, and verifying orders with the critical care clinical pharmacist sitting alongside them throughout the week to assist with complicated questions or inform them of operational nuances of ICU staffing. After this training, the residents were transitioned to staff independently as clinical pharmacists on day shift and were expected to attend rounds, serve as the pharmacy resource for their respective units, and be responsible for 10 to 15 patients in a surge ICU.

Clinical staffing of designated COVID-19 ICUs

The majority of pharmacy residents were placed into COVID-19 surge ICU units. The pharmacy residents were strategically placed in converted ICUs because patients in those units were not as critically ill as the patients housed in the legacy ICUs. All nurses from the general care unit were paired with a redeployed ICU nurse to care for 1 patient, and 1 or 2 critical care-trained attending physicians were on service per unit. Patient care responsibilities on the ICU floor were divided among 4 individual provider teams overseen by redeployed, rotating physician fellows from a variety of specialties, including pulmonology, critical care, hematology, oncology, and cardiology. The pharmacy residents split the 4 teams amongst other pharmacy

residents or clinical pharmacists. Each team also included a first- or second-year medical resident; the medical residents rotated frequently among teams.

It quickly became apparent that pharmacy residents would play a vital role in ensuring that patients received optimal care during their stay in an ICU. Each pharmacy resident was present for morning rounds with his or her patient care team and served throughout the day as the primary resource for drug information questions, in addition to order verification and therapeutic monitoring documentation. Due to the nationwide shortage of personal protective equipment, only nurses and physicians were entering patient rooms during the month of April. Pharmacists and pharmacy residents joined patient care rounds without entering the patient rooms. Pharmacists also used a standardized checklist to monitor for common COVID-19 treatment–related medication toxicities. The checklist included daily monitoring of liver function test results, renal function, and levels of creatinine kinase, D-dimer, and triglycerides in patients receiving propofol; and monitoring of the cardiac QT interval in patients receiving hydroxychloroquine and azithromycin. (Of note, the use of hydroxychloroquine in patients with COVID-19 is no longer standard of care.) For example, pharmacists employed the checklist to monitor liver function tests for patients treated with remdesivir or to closely monitor triglycerides in patients receiving high-dose propofol. Clinical pharmacists and the pharmacy residents were integral in communicating drug shortage information to the healthcare team and assisting with transitions to alternative medications, such as when the institution faced an IV hydromorphone shortage and units had to make the transition to IV fentanyl drips from IV hydromorphone drips.

Emergency responses on the units were frequent and required immediate pharmacist intervention. During code blue events pharmacy residents regularly compounded pressors, sedation agents, and paralytics immediately outside of a patient room (because, as previously mentioned, they could not enter rooms due to the PPE shortage) while communicating via telephone with the medical team in the patient room to deliver dosing and therapy recommendations. In addition, pharmacy residents were at the center of managing optimal analosedation on every team, given the teams' varying comfort levels with ICU practice.

In the event a resident staffing an ICU encountered particularly difficult patient cases or drug information questions, there was always a designated critical care clinical pharmacist practicing with one of the other care teams on the ICU floor who was accessible to the resident. The level of oversight the critical care clinical pharmacists provided to pharmacy residents varied, but these pharmacists provided feedback during the month by evaluating the residents' thought process or making suggestions for answers to complicated questions. They periodically checked in with the pharmacy residents throughout the ICU staffing weeks to see if they required any assistance.

Well-being of pharmacy residents during the pandemic

During the early months of the COVID-19 pandemic, healthcare professionals across the system and pharmacy residents were asked to step outside of their comfort zones to meet the clinical needs of the organization. While this was occurring, pharmacy residents were also facing the personal consequences of social distancing from their families and friends. Throughout the resident ICU staffing period, the PGY1 residency leadership hosted

videoconference calls every other week to check in with residents regarding their mental health. In addition, members of the PGY1 pharmacy residency class hosted their own videoconference calls to check in with one another. The pharmacy department hosted weekly “town hall” sessions that highlighted the well-being resources available to all staff through the institution. This was a trying time for the residents involved, as the patient population was vulnerable and witnessing patients’ isolation from their loved ones was difficult to bear. The stress of taking on a new level of responsibility as an independent clinical pharmacist bore down on the residents daily, and each had to develop coping mechanisms to manage his or her own well-being, with some residents bearing the burden more efficiently than others. One resident reached out to a peer-to-peer assistance program available at the hospital to talk through the challenges of being called into the ICU and to process the mixed feelings of being proud to be in the position to help patients and guilt at hoping ICU duty would end as the patient volume decreased.

Recovery

As the number of COVID-19 ICU and COVID-19 general care patients admitted to the hospital plateaued and decreased in early May, each individual resident worked with the PGY1 RPD to determine a plan for residency completion. Most PGY1 residents were transitioned from COVID-19 ICUs to their regularly scheduled rotation plan for the remainder of the year. Residents who had been pulled from a core rotation, such as pharmacy administration, had their rotation schedules shifted in order to fulfill their residency requirements. Any residents who were pulled from a core rotation in April fulfilled the requirements in May. Residents who

had been trained in the ICUs for patient care through the process outlined previously were given the opportunity to pick up ICU pharmacist staffing shifts on a per diem basis on evenings or weekends in May in addition to resuming their rotation schedules. Many residents decided to continue to help in the ICU after completion of ICU rotations, balancing those duties with their newly assigned rotation responsibilities.

Preparation for the future

The future of the COVID-19 pandemic is uncertain, but there are some recommendations that can be considered moving forward with the potential for a second wave of COVID-19 cases or an influx of patients without COVID-19 who deferred care during the initial surge.

Providing additional resident cross-training. Incoming residents for the 2020-2021 year should be cross-trained in the ICUs and other areas early in their residency year in addition to the traditional training for medicine staffing, order processing, compounding, and emergency response. We recommend continued pharmacist oversight and assistance even after ICU training is complete so that residents have an accessible resource if they are independently staffing in ICUs.

Adjusting to work from home. Future residents and preceptors are acclimating to the idea that some rotations may be based from home using videoconferencing applications to participate in rounds and complete topic discussions. This will limit the amount of direct patient care residents may be able to provide, and disruption of those experiences should be minimized. Preceptors will need to modify their rotations to continue to fulfill the objectives of

the rotation; therefore, further training and new precepting strategies will need to be developed.

Integrating education with clinical activities. The lecture series provided by the DGPE and critical care pharmacists was helpful to the residents as well as clinical pharmacists who might have been pulled into different practice settings. We recommend continuing this lecture series for the incoming PGY1 residents and interested clinical pharmacists, regardless of the situation surrounding the pandemic. COVID-19–related topic discussions should be expanded to include mechanical ventilation in hypoxemic respiratory failure, sedation, analgesia, paralysis, vasopressors, sedation and analgesia weaning, and delirium and agitation in post-ICU patients.

Creating resident opportunities in telehealth. Telehealth opportunities are a way pharmacy residents could expand services and provide more direct patient care in both the inpatient and outpatient settings. Since the COVID-19 pandemic has brought the importance of this practice into the spotlight and the Coronavirus Preparedness and Response Appropriations Act loosened restrictions on telehealth,² it would be prudent that pharmacy residents are adequately trained on telehealth essentials and provided access through the hospital's telehealth system to schedule virtual visits.

Establishing advanced resident roles in emergency response. With the emergence of critically ill patients with COVID-19 came a sharp increase in emergency response events. In line with our recommendations surrounding ICU cross-training, we recommend pharmacy residents and pharmacists be instructed on the most up-to-date guidelines on advanced cardiac life support along with COVID-19–specific clinical pearls for use in the event of a second surge. Pharmacists have already demonstrated their ability to contribute to reductions in patient

deaths when incorporated as members of code response teams, a role in which we have a critical opportunity to provide timely drug expertise at the bedside.³

Building on existing mental health resources. The orientation period for the incoming class of residents should not only include hospital resources already available but also provide additional resources. Some examples include resources available through ASHP,⁴ such as the Well-Being and Resilience Series, a series of webinars available to ASHP members; and Centers for Disease Control and Prevention recommendations for coping with stress during the pandemic.⁵ Personal check-ins with residents should also be built into the program and established with the PGY1 residency leadership so that residents feel they have support and resources available.

Broadening pharmacists' and residents' scope of practice. We should advocate for an expanded pharmacist scope of practice within our institutions and at the state and federal levels. For example, the Public Readiness and Emergency Preparedness Act⁶ authorized pharmacists to order and administer COVID-19 tests. In addition, our institution has implemented a post-ICU delirium monitoring program that, if protocolized, could allow pharmacists to directly manage taper regimens and discontinue medications posing a high risk of worsening delirium. Pharmacists remain on the edge of achieving provider status, which could grant our profession many of these freedoms.

Conclusion

The onset of the COVID-19 pandemic caused healthcare professionals to reevaluate the allocation of resources, and our institution's department of pharmacy elected to deploy

pharmacy residents to assist in caring for an ICU patient census that had doubled. Working closely with critical care clinical pharmacists, pharmacy residents were trained on established ICUs and placed in newly converted ICUs to work with other members of the healthcare team to optimize patient care provided to ICU patients with COVID-19. Through live video lectures and on-site training, pharmacy residents were trained and quickly integrated with ICU teams. Although the hospital was recovering from the initial COVID-19 case surge at the time of writing, the future of this pandemic was uncertain as the Commonwealth of Massachusetts began its phased reopening. Additionally, we must prepare for another potential COVID-19 wave as well as a surge of patients without COVID-19 who have deferred care. Plans should include moving forward with cross-training residents, optimizing work-from-home training, providing new clinical educational sessions, telehealth opportunities, emergency response advancement, mental health support, and advocacy for broadening pharmacists' scope of practice. Ensuring the residency class is well prepared for this new and evolving environment in healthcare will be paramount in ensuring their success.

Disclosures

The authors have declared no potential conflicts of interest.

Additional information

The views and opinions expressed are those of the authors and do not reflect the views of Massachusetts General Hospital.

Key Points

- The department of pharmacy at an urban Massachusetts medical center provided clinical support to the institution during the early months of the COVID-19 pandemic by training and deploying postgraduate year 1 pharmacy residents and non-intensive care unit (ICU) clinical pharmacists to staff designated COVID-19 ICUs.
- We wrote this paper to describe the pharmacy resident's perspective on how the department prepared and trained the pharmacy residents for ICU staffing.
- Additional recommendations on how to move forward in the event of a second wave of coronavirus are provided.

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Figure 1. Mechanical ventilator utilization at Massachusetts General Hospital from late March through late May 2020. The yellow line depicts the trend of total daily numbers of patients requiring mechanical ventilation at the institution, including patients confirmed to be infected with the coronavirus disease 2019 (COVID-19) virus (blue bars), those deemed at risk for COVID-19 but whose infection status had not been confirmed as either positive or negative (orange bars), and those ventilated for reasons other than confirmed or suspected COVID-19 (gray bars).

~~Patients requiring mechanical ventilation from March 23, 2020, to May 29, 2020~~

