

Concepts in Disaster Medicine

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COVID-19 Pandemic Surge: After-Action Report of a Coalition of Emergency Departments in New York City

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Abstract

The coronavirus disease (COVID-19) pandemic has stressed the US health care system in unprecedented ways. In March and April 2020, emergency departments (EDs) throughout New York City experienced high volumes and acuity related to the pandemic. Here, we present a structured after-action report of a coalition of 9 EDs within a hospital system in the New York City metropolitan area, with an emphasis on best practices developed during the prolonged surge as well as specific opportunities for growth. We report our experience in 6 key areas using a framework built around lessons learned. This report represents the most salient concepts related to our institutional after-action report, and those seemingly most relevant to our peer institutions dealing with similar circumstances.

Introduction

From March until early May 2020, emergency departments (EDs) throughout the New York City region experienced challenges they had never faced before and likely had only partially prepared for, at best.^{1–3} At the height of the surge, more than 6300 new coronavirus disease (COVID-19) cases were diagnosed per day, with more than 500 deaths daily in the city alone.⁴ New York City EDs were compelled to manage surge events in new ways, redefine ED critical care and ED palliative care, and act aggressively to mitigate infection risks to frontline providers.

The New York–Presbyterian (NYP) hospital system consists of 2 tertiary-care academic medical centers, 1 tertiary care children’s hospital, and 6 smaller community-based hospitals in New York City and the surrounding suburbs. Between March 1 and May 30, 2020, our EDs collectively treated approximately 92 000 patients, reaching an overall severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) polymerase chain reaction positivity rate of nearly 60%. Total positivity rates from our hospital system are shown in Figure 1. Total ED visits for COVID-like illness at our 3 busiest sites from January through June, 2020, are shown in Figure 2.

A timeline of the event is shown in Figure 3. The individual sites that comprise our hospital system function as a health care coalition (HCC) for the purposes of preparedness and emergency management. The first patient with laboratory-confirmed COVID-19 in New York State was admitted to NYP Lawrence Hospital via the ED on February 27, 2020. On March 2, the patient was transferred to the intensive care unit (ICU) at Columbia University Irving Medical Center. Thereafter, the HCC carried out a rapid response to the large volume of cases that inundated each of our 9 EDs. The response to the disaster in all EDs included improvisational critical care, complicated social work and discharge planning interventions, and the participation of multiple specialists and subspecialists.

Following an event or exercise, after-action reports (AARs) are 1 means of knowledge management intended to disseminate information and build on experience.⁵ The “lessons learned” approach suggested by AAR production, while clearly offering a level of evidence less robust than a randomized trial, can help practitioners learn from experience, improve current practice by mitigating the impact of disasters, and assist in the design of exercises and other quality improvement tools.

In early June 2020, the authors collaborated with clinical and administrative leaders, as well as frontline staff at each of the 9 EDs, to catalog and describe our organization-wide ED best practices and identify opportunities for strengthening the coalition’s response to future, similar events. Despite the ongoing nature of the pandemic at this time, we elected to evaluate our performance during the first surge (ie, March–April) in order to address and mitigate critical issues

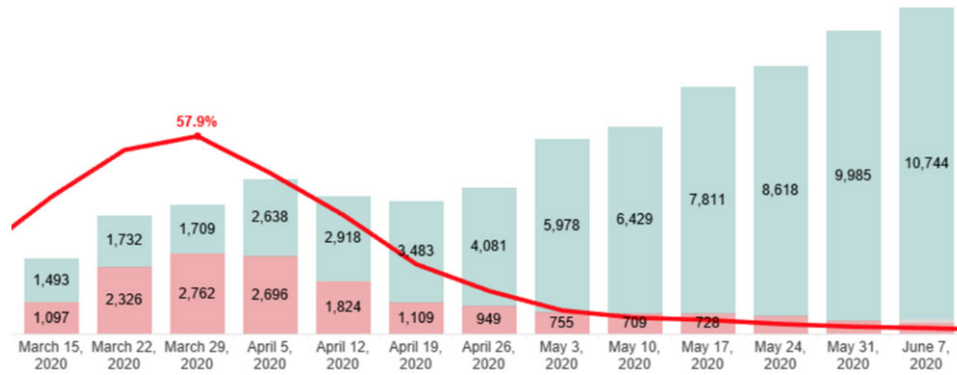


Figure 1. Positivity rates.



Figure 2. CLI visits.

in advance of a second potential influx of patients. The group identified 6 core performance areas that played a substantial role in our surge response: communication, patient management, operational structure, wellness and staff support, data management, and staffing.

This report reflects the experience of the EDs of NYP (“the coalition”): NYP Allen, NYP Brooklyn Methodist, NYP/Columbia University Medical Center, NYP Hudson Valley Hospital, NYP Lawrence Hospital, NYP Lower Manhattan, NYP Morgan Stanley Children’s Hospital, NYP Queens, and NYP/Weill Cornell Medical Center. While the experience here is clearly specific to a catastrophic pandemic, the recommendations in this

report should prove valuable for future protracted patient surge events.

Analysis of Capabilities

In each area, we identified opportunities for improvement and best practices. Opportunities for improvement represent areas where operational alterations can enhance system effectiveness (which includes patient outcomes and staff health and wellness). Best practices are understood to be operational or clinical initiatives that maximized overall effectiveness throughout the crisis.

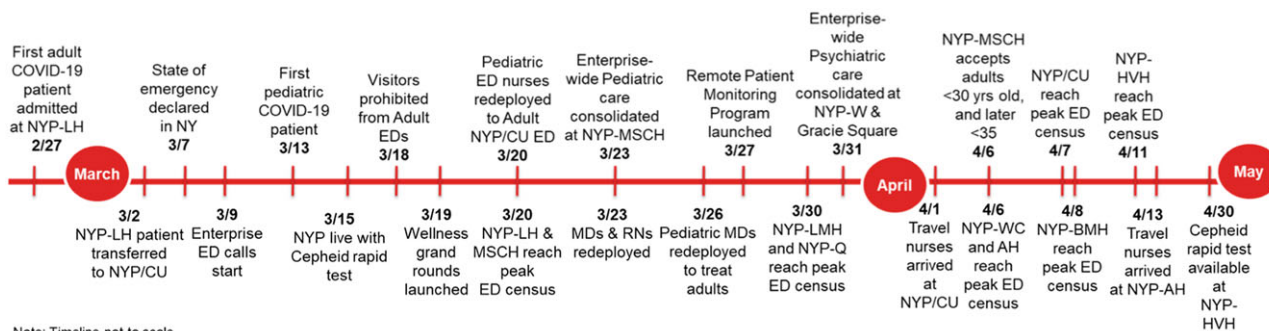


Figure 3. Timeline.

Focus Area 1: Communication

Inter-ED Communication Strategies

Opportunity: The communication among the 9 ED groups served as an important forum for sharing clinical experiences as well as developing coalition-wide protocols for the evaluation and treatment of COVID-19 patients (for example, guidance for prone positioning of hypoxic ED patients).⁶ As this collaborative communication system was new to the EDs in our coalitions, we will aim to “hardwire” the system into our disaster response by incorporating the conferences into our respective disaster plans. This will include pre-designation of roles and responsibilities and the development of secure, redundant means of communication.

Best practice: For several months, we conducted a nightly multi-disciplinary teleconference that included the 9 ED leadership teams and pre-designated senior hospital executives. The conference lasted 1 hour and was held at the same time each evening. Agendas for the calls included a daily “report-out” regarding patient volumes and acuity, supply and staffing issues, and issues related to clinical care. Calls routinely included representatives from system-wide infection control, information technology, supply chain, transfer center, and pharmacy services. The level of transparency and information shared was crucial to understanding the state of operations across the coalition. This ultimately helped standardize care system-wide. As operations stabilized, the calls occurred less frequently.

Communications Standardization

Opportunity: Stakeholders in ED communications throughout the event included faculty of 2 medical schools, hospital employees, and hospital-based physician groups. Seeing that each group typically uses its own email, messaging, platforms, and so on, it became necessary to distribute important information via many electronic channels. The implementation of a single ED-wide communications and messaging platform would enable consistent and timely communication. Such a platform could similarly enable team-based collaboration and discussion.

Throughout the event, working groups from all of our coalition EDs developed clinical protocols and guidelines related to COVID-19 patient care (see below). We discovered that there was no “horizontal” distribution channel that could disseminate information to ED clinical teams throughout the coalition. We see an opportunity to create a dedicated multidisciplinary communication channel to identify and disseminate changing protocols and discuss clinical questions.

Best practice: Throughout the event, clinical and administrative staff received a tremendous number of communications in a

variety of formats. E-mails, texts, and videoconference-based updates from multiple sources were potentially overwhelming and often contained redundant information. To streamline the process, we instituted a system in which important information was synthesized and distilled on a daily basis and distributed to staff via e-mail from a limited number of trusted sources at each site. Bi-directional communication was facilitated via the use of regularly scheduled videoconferences and the establishment of e-mail addresses to directly contact the administrators responsible for managing the event. Some sites implemented a team-based online work collaboration solution (Microsoft® Teams, Microsoft Corp., Redmond, WA) with varying degrees of engagement.

Focus Area 2 – Patient Management

Telehealth Expansion and Remote Monitoring

Opportunity: The expansion of telemedicine services during the surge allowed for increased capacity throughout our system. As we continue to develop surge telehealth, it will be critical to make telemedicine more accessible to a broader population, taking into consideration access to broadband Internet, ability to pay, and ability to accept insurance. Ideally, telehealth platforms have multi-lingual capabilities. Training in telemedical practice, both in patient assessment and “websites manner,” could optimize equitable and efficient use of the technology.

Best practice: Telehealth use was significantly expanded during the surge. Some of the ED providers had experience with virtual urgent care, but this was rapidly expanded during the pandemic, integrated with our standard electronic medical record, and fully staffed by ED physicians. In March and April 2020, the hospital system’s ED-based virtual urgent care service experienced a 20-fold increase in patient volume, seeing up to 300 patients per day.⁷ Real-time tele-consults by other specialty services helped mitigate physician and staff exposure to COVID-19 patients.

During the initial surge event, inpatient capacity was markedly constrained. In order to provide standard-of-care treatment to lower-risk COVID-19 patients, follow-up systems enabled a subset of patients to be discharged with close follow-up. Following the development of a low-risk ED treatment algorithm used throughout our coalition, we discharged patients with pulse oximeters and/or oxygen concentrators (depending on the degree of hypoxia), coupled with rapid follow-up telehealth appointments to monitor their condition. Telemedicine visits allowed remote assessment of respiratory status, respiratory rate, and oxygen saturation by physicians and advanced practice providers (APPs). In a cohort of 677 patients enrolled in the program between March 29 and April 17,

2020, 86 (12.7%) patients returned to the ED and were admitted, and 16 (2.4%) required ICU level care.⁸

Palliative Care

Opportunity: The coalition quickly recognized the critical need for seamless integration of palliative care teams into the ED setting. The need for this was twofold: at hospitals without dedicated palliative care teams, a telemedicine solution could augment palliative care services, and ED frontline teams benefited from palliative care training specifically focused on structured

“goals of care” discussions.^{9,10} During an emergency in which visitors are not permitted at the bedside of the patients, HIPAA-compliant access to videoconferencing technology (eg, bedside electronic tablets) should be facilitated. Such a strategy for communicating with families and caregivers may be useful even outside the constraints of a pandemic. Clear communication of goals of care – particularly in patients arriving from long-term care facilities – could be improved by more widely adopting the electronic medical record to that purpose. In New York State, for example, the eMOLST system can make prehospital care directives available online to emergency clinicians.¹¹

Best practice: A team of palliative care physicians was embedded in the EDs of our 2 academic medical centers throughout the highest volume weeks of the surge. The teams identified patients with poorer prognosis and led goals of care conversations with families in real time.¹² At other sites, palliative care interventions were facilitated by hospitalist teams and psychiatry clinicians, both via telehealth technology and in person. A formal palliative care consult system developed as the event progressed.

Discharge Planning and Care Pathways

Opportunity: Many COVID-19 patients who presented to our EDs were medically stable for discharge but did not have safe places to return. Some public resources (eg, “COVID hotels,” which could safely house medically stable patients who could not self-isolate elsewhere) became available to these patients as the event progressed. ED-based social work and care coordination can facilitate a more timely, structured disposition and discharge policy for vulnerable patients who are potentially contagious but either undomiciled or unsafe at home.

Best practice: Working groups of clinicians from all sites collaborated on the development and dissemination of evidence-based clinical pathways specific to ED care. The pathways provided clinical guidance for frontline clinicians and ensured that our EDs collectively abided by a uniform standard of care across a wide geographic area and diverse patient populations. Working groups similarly developed patient-facing instructions for discharge with oximeters and oxygen concentrators, as well as guidance for self-positioning while in the ED.

Drills and Exercises

Opportunity: ED disaster drills often focus on high-impact, acute events such as traumatic mass casualty incidents or active shooter events. While our departments have undertaken small-scale, pathogen-related drills in recent years (eg, arrival of an Ebola patient to the ED), there have been few exercises related to infectious mass casualty events. We are now in a position to implement tabletop drills and full-scale exercises that more accurately reflect the needs of a longer term, high impact event. Such drills should be part of a routine preparedness program as required by regulators such as the Centers for Medicare & Medicaid Services.¹³

Cohorting and Patient Flow

Best practice: Early in the crisis, pediatric patients from all sites were preferentially directed to the children’s hospital for admission, thus creating capacity for adult COVID-19 inpatients at our other coalition sites. Similarly, psychiatric patients were preferentially directed to our dedicated psychiatric hospital rather than admitted throughout the system. Critical care patients were concentrated at 2 tertiary care academic medical centers. Each of these strategies directly impacted ED patient flow and clinical care. As centralized ICU capacity became saturated during the patient surge, several EDs established “pop up” ICUs within ED space. These patients were managed jointly by ED and critical care physicians, including “redeployed” clinicians from other specialties (attending physicians, house staff, and APPs) working under the supervision of the critical care service.

As the event progressed, we transferred several ED patients from an overburdened community ED (over 200% capacity, staffing shortage, high critical care census) to the EDs of our tertiary care centers in order to more evenly distribute patients and relieve system-wide pressure.

Focus Area 3 – Operational Structure

Restructuring of Physical Space

Opportunity: As noted, the conversion of ED spaces to negative pressure rooms progressed on an *ad hoc* basis with different engineering solutions at each site. A future plan detailing the steps necessary to provide appropriate care space (single rooms, isolation areas, negative pressure, decontamination) during an infectious mass casualty incident will allow a nimbler response in the future.

Similarly, the location and optimal uses of temporary structures (ie, tents) can be pre-determined for a variety of scenarios, addressing different types of events, patient characteristics, and environmental conditions such as weather, road closures, and so on. For future infectious mass casualty events, temporary structures could similarly be dedicated to single-purpose objectives like testing or vaccination, or else designated by patient population (low-acuity, airborne isolation, and so on).

Best practice: The number of COVID-19 patients quickly outnumbered the number of negative pressure rooms available, which were reserved for patients undergoing aerosolizing procedures. Several ED care spaces were rapidly converted to *ad hoc* negative pressure rooms via the installation of appropriate airflow equipment. “ED-ICU” spaces added to the total number of ICU-capable beds available in our system. At some sites, additional care spaces in close proximity to the ED (ie, an endoscopy suite) were also converted to available space for boarding critically ill patients.

Some low-acuity patients were diverted to alternative care locations, including tents and waiting room spaces converted to clinical areas, as well as specialty clinics (eg, patients with isolated non-emergent eye complaints were directed to the ophthalmology clinic after a medical screening exam). Telemedicine devices in waiting rooms allowed for remote evaluation of lower acuity patients; in this case, patients were triaged by in-person nursing staff and directed to a private telemedicine “booth” in which ED visits were conducted by a remote physician and on-site APP. At 1 site, in which adult and pediatric EDs are physically separate but proximate, stable young adult patients age 24 and younger were transported to the pediatric ED for evaluation after initial triage. This preserved capacity at the adult site (the normal age cutoff is 20).

Implementation of Incident Command System

Opportunity: Our coalition uses the Hospital Incident Command System (HICS) to manage emergencies.¹⁴ Over a large and complex system, however, the HICS warranted reinforcement, especially as many components of the system were implemented virtually rather than at in-person command centers. Consistent training across all levels of the organization would help address the need for individuals to perform roles in which they are not normally accustomed. Additional exercises in implementing HICS over an entire hospital system, rather than at individual sites, would likely be valuable as well. As we discovered an urgent need to re-balance ED volume among sites (ultimately shifting patients from an overburdened site to 1 with nominal reserve), some uncertainty developed as to whether a single identifiable clinical leader had information and authority to make the appropriate changes. Greater adherence to an HICS framework could be 1 way to address this shortfall. For improved real-world applicability, organizations would need to ensure that adequate HICS training is available for staff in multiple disciplines, and that an HCC has the capacity to maintain HICS-based operational structure during long-term events.

Focus Area 4 – Wellness and Staff Support

Mental Health Support for All Staff

Opportunity: Additional research may help demonstrate the specific types of mental health support deemed most effective during a long-term event. For a large health care system, a primary goal is to ensure similar levels of support across geographic sites and across disciplines (ie, nursing, support staff, and emergency medical services providers). Long-term support could help mitigate the effects of adverse psychological effects and stress injury in the future.^{15,16}

Best practice: The availability of a diversity of mental health services, from online presentations and group peer debriefing sessions and individual counseling sessions, was frequently communicated to clinical staff. At 1 site, “opt-out” individual brief counseling sessions with faculty psychiatrists were scheduled for all clinicians. Making resources available early in the incident and in multiple formats was intended to de-stigmatize the need to seek mental health services and make the logistics of accessing those services less burdensome (for instance, scheduling free, flexibly scheduled opt-out virtual mental health visits with providers from our department of psychiatry).¹⁷

Focus Area 5 – Data Management

Standardization of Data and Data Visualization

Opportunity: Data are collected and analyzed differently among clinical sites, yet standardized and automated real-time data could help with future patient surges, especially in predictive capacity. In the case of COVID-19, more complete aggregation and visualization of data regarding patient volume, ICU bed availability, positive test rate, admission rates, and staffing (eg, nurse to patient ratios) would have enabled a more proactive response across the coalition.

Best practice: An enterprise-wide dashboard provided a view of the morning and evening census across all sites, informed staffing decisions across the EDs, and directed utilization of newly hired temporary staff and redeployment of clinical staff reassigned to new patient care areas. A COVID-19 dashboard included system-wide inpatient census, ICU census, length of stay data, and test positivity rates. Patient volume predictions provided operational agility and informed early decisions on operational changes.

Focus Area 6 – Staffing

Physician and Nurse Redeployment

Opportunity: Nursing skill sets, competencies, and privileges vary greatly across clinical sites. A comprehensive database of staff competencies, particularly those most applicable to redeployed staff working in emergency settings, could allow more rapid and effective redeployment of nurses. ICU-level interventions done in the ED would be a relevant example, as would skills related to goals of care discussions and end-of-life care. Such a database could be accompanied by a system-wide disaster redeployment process for nurses, with expedited unit-specific onboarding and access to IT systems and security access (key cards, and so on).

Best practice: The redeployed physicians and nurses provided essential support. Physician teams from other services (for example, a team consisting of an orthopedic surgery attending and orthopedic surgery residents) were deployed to particular missions within the ED (eg, covering ICU patients under the supervision of the critical care service, or caring for boarding inpatients). Pediatric emergency medicine faculty physicians and fellows cared for adult ED patients both in person and via telemedicine. We developed an *ad hoc* system for onboarding and orienting redeployed nurses and physicians, while attempting to ensure an appropriate level of supervision (redeployed resident physicians working in EDs were supervised by emergency physicians, critical care patients boarding in the ED were cared for by physician teams supervised by critical care physicians).

Expedited Onboarding of New Staff

Opportunity: While the hiring of temporary or *per diem* employees, particularly nurses, during an emergency is not limited to the ED, the availability of temporary nursing staff greatly affected ED operations at most of the clinical care areas. Early in the response, many nurses were quarantined or out of work due to illness. For future large scale events, creation of a system to nimbly secure and on-board temporary staff during emergencies will be an enormous asset. Similarly, addressing contingency plans to overcome staffing shortages that were experienced by ancillary staff, for example, environmental services, patient transport, and so on, will be a key component of a refined plan.

Discussion

In early 2020, our coalition of EDs in New York City and its suburbs experienced an unprecedented patient surge related to the COVID-19 pandemic. We found that the nature and scope of the event led to both predictable and unpredictable challenges related to ED operations and patient care. Key after-action findings are presented here with the assumption that they are applicable to a wide variety of hazards and will be instructive to EDs outside of our own institution.

AARs are often neglected as organizations recover operations and return to “business as usual.” Nonetheless, the analysis offered by an AAR is critical to future risk mitigation.¹⁸ Oftentimes, organizations experience a disconnect between the observation of challenges and the implementation of solutions, even when specifically suggested in AARs.¹⁹ Those reports can better guide institutional change if formalized procedures are developed to guide improvement efforts. To reduce the likelihood of this oversight, we generated short and long-term institutional goals related to each focus area with designated working groups specific to each topic. Those

solutions will need to be evaluated with coordinated drills, exercises, tabletops, and simulations, as they will likely be tested again.

Throughout the event, we provided care in a resource-limited setting. The conclusions here may ultimately be generalized to build capacity throughout a variety of ED settings intending to develop a comprehensive approach to pandemic, disaster, and mass casualty preparedness.

Limitations

As with many AARs, the “lessons learned” may not be applicable to all, may not be institutionally appropriate for other types of emergencies, or may not be effectively applied or communicated. The themes presented here represent a consensus perspective of ED clinical leaders, although they may not reflect the most pressing issues from a patient-centered viewpoint. In the wake of the emergency, recall bias may influence the description of events that have occurred in a setting of duress. There is a large amount of variability between 9 diverse campuses of a large health system, and so the conclusions here may not represent a uniform experience across all sites. In an ideal environment, an independent observer would have the opportunity to assess ED performance and suggest improvements, but we had no such evaluator available.

Conclusion

Our experience in 9 high-volume EDs during the COVID-19 patient surge identified effective solutions to novel problems. The experience also reinforced long-standing preparedness needs and introduced opportunities to re-engineer a system to prepare more effectively for many types of events. We experienced a patient surge that, essentially, was a protracted and severe mass casualty incident, compounded by an immediate infectious risk to our staff. The best practices and suggested improvements described here will ideally shape preparedness efforts for a wide range of hazards in EDs.

Acknowledgments. The findings discussed here reflect the hard-won experiences of hundreds of frontline clinical and support staff. Each of them deserves recognition for his/her dedication and compassion during unprecedented circumstances. We acknowledge the commitment and sacrifices made by all frontline staff, providers, and personnel at our institutions during the COVID-19 crisis, and the suffering and loss of our patients, their families, and our community.

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