

# UCSF

## UC San Francisco Previously Published Works

### Title

Emergency department preparation for COVID-19: accelerated care units

### Permalink

<https://escholarship.org/uc/item/6zp147j2>

### Journal

Emergency Medicine Journal, 37(7)

### ISSN

1472-0205

### Authors

Noble, Jeanne  
Degesys, Nida Felicija  
Kwan, Elizabeth  
[et al.](#)

### Publication Date

2020-07-01

### DOI

10.1136/emered-2020-209788

Peer reviewed

# Emergency department preparation for COVID-19: accelerated care units

Jeanne Noble, Nida Felicija Degesys, Elizabeth Kwan, Edward Grom, Cortlyn Brown , Jahan Fahimi, Maria Raven

## ABSTRACT

By 11 February 2020 when the WHO named the novel coronavirus (SARS-CoV-2) and the disease it causes (COVID-19), it was evident that the virus was spreading rapidly outside of China. Although San Francisco did not confirm its first locally transmitted cases until the first week of March, our ED and health system began preparing for a potential COVID-19 surge in late February 2020.

In this manuscript, we detail how the above responses were instrumental in the rapid deployment of two military-grade negative-pressure medical tents, named accelerated care units (ACU). We describe engagement of our workforce, logistics of creating new care areas, ensuring safety through personal protective equipment access and conservation, and the adaptive leadership challenges that this process posed.

We know of no other comprehensive examples of how EDs have prepared for COVID-19 in the peer-reviewed literature. Many other EDs both in and outside of California have requested access to the details of how we operationalised our ACUs to facilitate their own planning. This demonstrates the urgent need to disseminate this information to our colleagues. Below we describe the process of developing and launching our ACUs as a potential model for other EDs around the country.

## INTRODUCTION/BACKGROUND

By 11 February 2020 when the WHO named the novel coronavirus (SARS-CoV-2) and the disease it causes (COVID-19), it was evident that the virus was spreading rapidly outside of China. Although San Francisco did not confirm its first locally transmitted cases until the first week of March, our ED and health system began preparing for a potential COVID-19 surge in late February 2020. Because of increases in inpatient boarding in our ED and reliance on hallway beds for patient care, it was clear that our capacity

for respiratory isolation was severely limited.

In anticipation of a rapid increase in COVID-19-related ED volume, we engaged in urgent interprofessional and interdisciplinary collaboration with an emphasis on leveraging existing resources, workflows and communication platforms to focus on COVID-19 and surge planning.

In this manuscript, we detail how the above responses were instrumental in the rapid deployment of two military-grade negative-pressure medical tents, which we named accelerated care units (ACU). We describe engagement of our workforce, logistics of creating new care areas and the adaptive leadership challenges that this process posed. Many other EDs both in and outside of California have requested access to the details of how we operationalised our ACUs to facilitate their own planning. We know of no other comprehensive examples of how EDs have prepared for COVID-19 in the peer-reviewed literature. We describe the process of developing and launching our ACUs as a potential model for other EDs both nationally and globally.

## OVERVIEW OF ACUS; DESCRIPTION AND IMPLEMENTATION

From concept to execution, the process of implementing our ACUs was rapid. While our existing surge plans included mass casualty tents being assembled in our ED parking area, these shelters would not be a sustainable solution for a pandemic projected to last months. In collaboration with our health system emergency management office, we purchased two negative-pressure treatment shelters (BLU-MED Response Systems, Kirkland, WA) at a cost of approximately US\$100 000 per unit.

We operationalised these two shelters (ACU-1 and ACU-2) over a 6-day period from delivery on 2 March to patient care on 8 March 2020. From 8 March until 11 April 2020, a total of 504 patients were seen in the ACUs, representing approximately 45% of all patients tested for COVID-19 through our ED. Erecting and

outfitting the ACUs at this pace required clear agreement on the urgency of the endeavour, and the full support of health system leadership who dedicated staff from across the institution to the project. Throughout this process we reported updates to our health system executive leaders.

We engaged our facilities and engineering teams to create blueprints laying out tent positions in our ED parking area. These teams also identified sufficient outdoor electrical power to support two negative pressure shelters, including heating/ventilation, as well as necessary clinical equipment. Our information technology teams placed a Wi-Fi extender while facilities obtained portable toilets and sinks with running water.

Once the ACUs had been erected in the parking area adjacent to the ED, design and construction teams presented plans to the appropriate regulatory agencies and helped expedite our requests. The ACUs received 90-day approval as clinical areas by the California Office of Statewide Health Planning and Development. Each ED will have to navigate unique regulatory processes, underscoring the importance of partnering with institutional compliance and regulatory offices.

The layout of our shelters, while modifiable and adaptable, was initially developed as follows:

- ▶ ACU-1: full triage, patient care occurs in chairs, rapid treat and release without nursing involvement after triage process and/or waiting area for evaluation by a provider; portable X-ray available inside.
- ▶ ACU-2: treatment cots/trolleys where a nurse is assigned to each patient, higher acuity patients, full ED treatments available.

Additional logistical considerations included rapid printing of outdoor signage by our printing office, creation of designated areas for outdoor COVID-19 testing (oropharyngeal and nasopharyngeal swabs), waiting areas for patients and appropriate comfort measures for staff working outdoors (overhead coverage, warm staff jackets and electric heat lamps).

## MATERIALS

We chose supplies and equipment that would facilitate the safest and most efficient use of the ACUs. In order to assure all patients are served, video language interpreters via iPads are available at all times.

Department of Emergency Medicine, University of California San Francisco, San Francisco, California, USA

**Correspondence to** Dr Cortlyn Brown, Emergency Medicine, University of California San Francisco, San Francisco, CA 94110, USA; cortlyn.brown@ucsf.edu



### Set-up

Opaque, easy-to-clean, plastic curtains are hung within each ACU, decreasing risk of infection between patients, and each patient chair or trolley is placed 6 feet apart.

### Medications

To reduce infection risk, we use individual disposable water bottles for medication administration. With our ED pharmacists, we developed a policy to allow providers to order, administer and document medication administration on paper which is later entered and reconciled in the electronic medical record. Kits are prepacked and contain acetaminophen, ondansetron and an albuterol metered dose inhaler with a spacer. This allows the ACU to operate without a dedicated treatment nurse, minimising delays and exposure to staff, and conserving personal protective equipment (PPE).

### Monitoring and imaging

Each treatment space inside the ACUs has a dedicated monitor for pulse oximetry, cardiac rhythm and BP, as well as thermometers for temperature measurement. A dedicated portable X-ray machine for ACU-1 allows many patients to receive the entirety of their care without needing to be transferred into the ED. An EKG machine is shared between the two ACUs

### Supply storage

A nearby supply closet houses all supplies and medications when not in use, PPE, dedicated portable oxygen tanks and other materials.

### MOBILE-FRIENDLY TEAM COMMUNICATION

To keep staff current with rapidly changing policies and workflows, we used a cloud-based microlearning platform Elemeno (Elemeno Health, Oakland, CA), accessible on demand, desktop or mobile (see figure 1). We directly updated policies in real time. Staff were required to check updates posted on Elemeno immediately prior to, and once again during, their shift. This reduced email fatigue, kept providers up to date, allowed staff to submit feedback and accelerated optimisation of workflows. We discouraged posting of policies and procedures on paper as we did not want outdated materials circulating in the clinical areas. By using Elemeno as the only information repository, the new platform was rapidly adapted by front-line staff. During the month of March, our COVID navigator was accessed more than 2500 times by ED staff.

### ACU RESUSCITATION

We developed a specialised ACU periarrest resuscitation algorithm in the event a patient requires resuscitation and rapid transfer into the main ED. Key ACU and ED staff wear two-way radios, allowing instantaneous communication. In emergent situations, the ACU staff radio the ED charge nurse to overhead page 'CODE in the ACU'. A designated ED team will respond to assist the ACU staff. ACU providers will intubate via laryngeal mask airway or video laryngoscopy before transferring the patient via backboard to a trolley stationed outside the tent. There, the awaiting ED team transfers the patient

to a private ED isolation resuscitation room treated by staff in appropriate PPE. The decision to perform intubations on periarrest patients in the ACUs was based on mock resuscitations demonstrating an over 7 min delay from recognition of patient distress to successful transfer of the patient into a resuscitation room.

### Security

Facilities staff erected a fence around the ACUs to secure them when not in use. The fence also provides an additional layer of privacy so patients cannot be seen entering the ACUs from the street. We closed our parking lot to private vehicles (ambulance traffic remains) and redeployed our parking security guard as an ACU security guard. This guard is stationed at the ACU when in use and rounds on the ACU when closed. At the outdoor triage, the guard screens all patients with a metal detector wand and bags are searched.

### COVID-19 TESTING

Given current availability of tests, we have been able to test most patients with symptoms including those patients stable for discharge. In order to reduce transmission risk, ACU patients are swabbed at an outdoor kiosk. To reduce the number of times individuals are entering or exiting the shelter, the swabs are obtained when the patient is on the way in for triage or on the way out as they are being discharged. Discharged patients do not wait for their test results. We developed standardised discharge instructions in our electronic health record and collaborated with our Office of Population

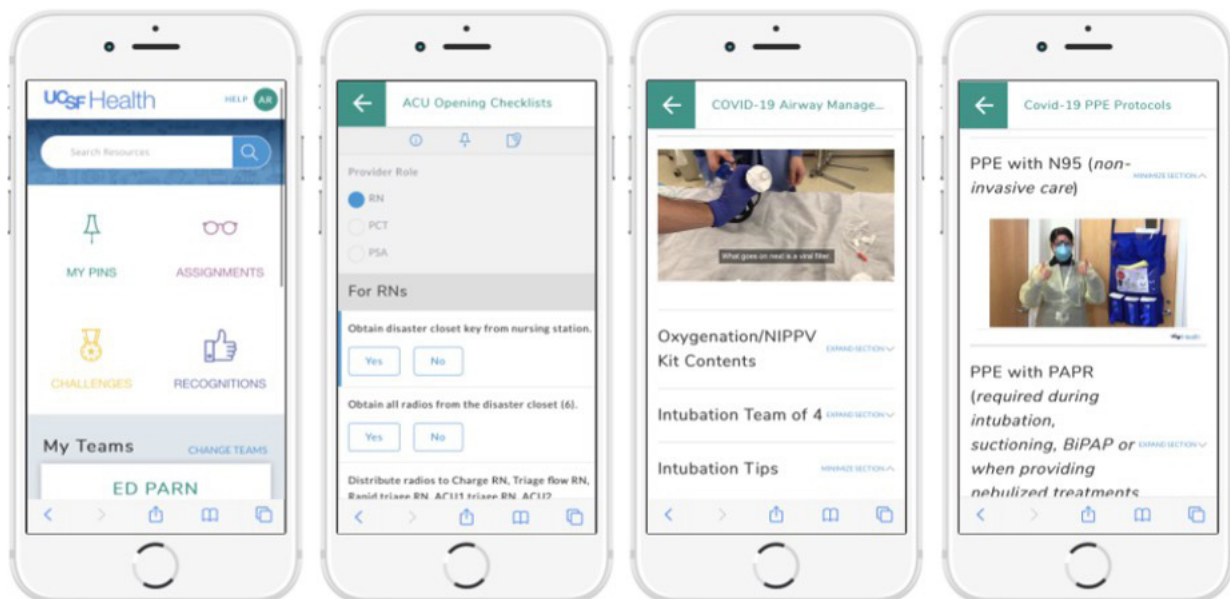


Figure 1 Elemeno ED home page, workflow checklists and clinical content as displayed on user's smartphone.

Health and Accountable Care to develop a robust follow-up system for patients with pending COVID-19 tests. We rely on an automated phone messaging system to communicate negative test results. Positive results are communicated by phone calls from nurse discharge coordinators who answer patient questions and reinforce self-isolation practices.

### ACU STAFFING

Adding our ACUs required a new mechanism for patient triage and additional registered nurse (RN) staffing. Existing ED staff who would normally care for low to moderate acuity patients in the main ED were shifted to work in our ACUs. Diverting existing providers from the ED to our ACUs did not compromise ED throughput.

Because of shelter-in-place orders first in San Francisco, followed by the state of California, overall ED volume decreased from mid-March to early April 2020. Additional capacity created by the health system (eg, postponing elective surgeries) eliminated ED boarding and provided workforce flexibility to meet demand in the ACU. As patient volumes increase during times of surge, we are prepared to increase ACU nursing staff to at least five (two triage nurses and two treatment nurses in addition to the rapid triage nurse) and use on-call providers as needed. Out of concern for potential increases in staff illness, we added a second layer of backup call (onto our existing on-call system) to ensure coverage in the event of unexpectedly high volumes or staff illness/quarantine.

We developed the ability for our quarantined staff to provide remote care in the ACUs using telemedicine. With the use of telemedicine, as well as expanded advanced practice provider (APP: physician assistant or nurse practitioner) coverage in the ACUs, we have capacity to expand the hours that the ACUs operate without increasing the number of shifts for attending physicians.

### LEADERSHIP ROLES

Given the amount of time and expertise required to implement our ACUs, our Chief designated one faculty member with expertise in disaster planning and simulation as the ED Director of Disaster for COVID-19. This individual worked closely with our Medical Director, Director of Performance Improvement and another junior faculty member. The Director of Disaster was able to help coordinate and respond to all ACU implementation

efforts working with other members of our leadership team.

To provide consistent messaging in a time of frequent changes and coaching to our numerous providers, we created an ED COVID-attending role held by members of our ED leadership team. The COVID attending leads our morning and afternoon ED huddles, coaches ACU providers and is available for questions and escalation of urgent issues to hospital leadership.

Given the ongoing limitations of COVID-19 testing, we have also used our ACUs to test all medical staff with symptoms and concerns for COVID-19 if they are unable to be seen and evaluated by occupational health or receive timely testing elsewhere. The ability to screen and test these individuals during non-business hours allows for expedited return to work for those who test negative and feel well.

### ACU WORKFLOW

As a tertiary care centre with specialised oncological and transplant services, a significant proportion of our patients are at high risk for developing severe illness if infected with COVID-19. We developed the ACU workflow in order to cohort patients with respiratory complaints, minimising staff exposure to infection and minimising potential exposure to other ED patients.

### Opening and closing

The ACUs are opened each morning and closed each night using a checklist to ensure they are stocked and ready to see patients the following morning after a thorough nightly cleaning.

### Rapid triage

Except for patients with immediate resuscitation needs, every ED patient starts at the rapid outdoor triage station (figure 2).

To minimise delays and exposure to administrative staff, we created a quick registration process that opens a patient encounter in the electronic medical record allowing providers to begin to care for patients immediately. An ED nurse stationed at rapid triage takes a temporal artery temperature and screens for COVID-19 symptoms (cough, shortness of breath and/or myalgias). If the patient is febrile or screens positive for COVID-19 symptoms, they are given an orange wristband and directed to the ACU for full triage. If the patient is afebrile and screens negative for COVID-19 symptoms, they receive a blue wristband that indicates

they have been cleared to enter the main ED and are directed to the internal waiting room for full triage. Bracelet colours allow staff to easily identify who is cleared to be in the main ED. All patients in the ACU and main ED receive a mask at the rapid triage station.

### Full triage

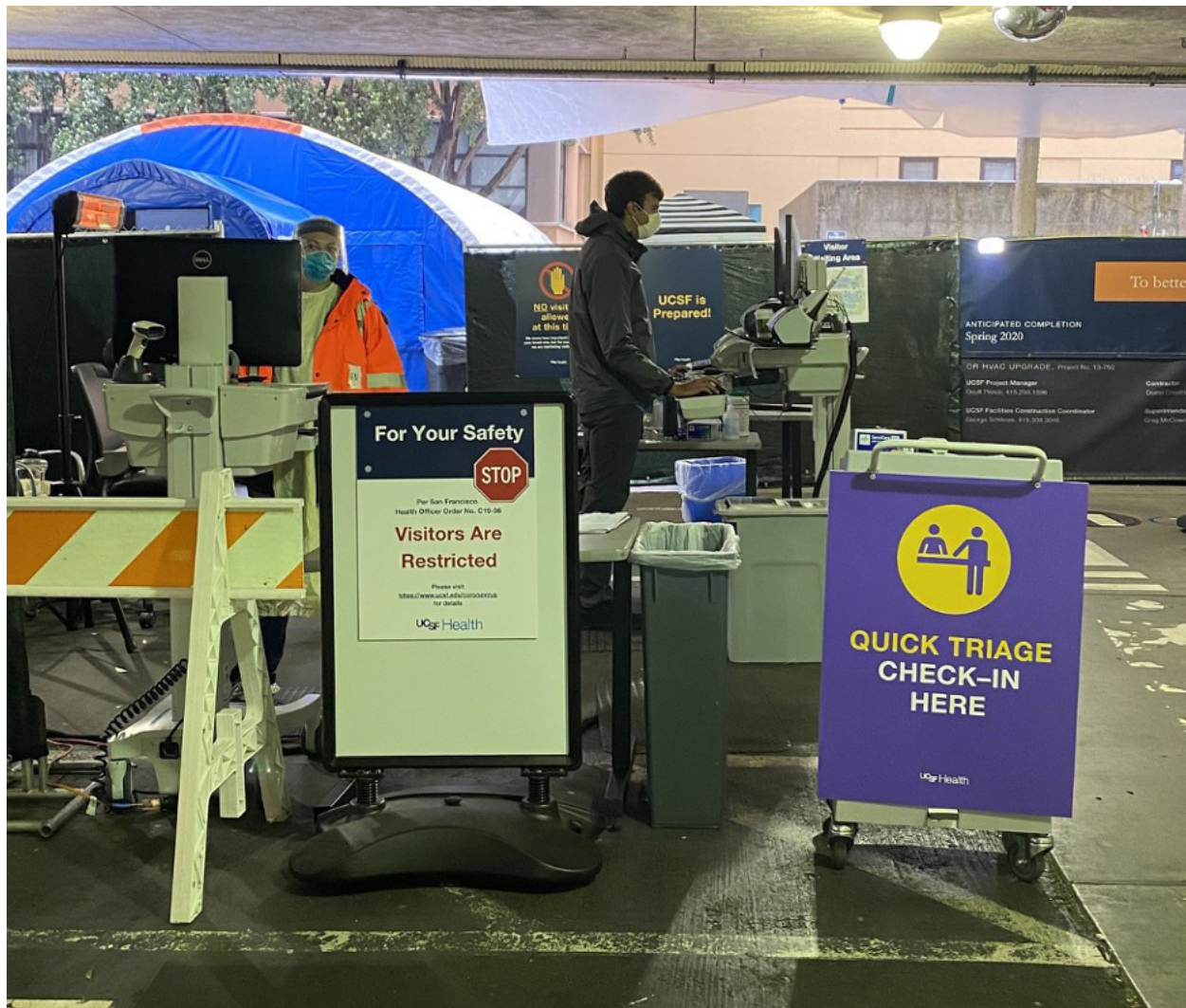
If a patient screens positive for possible COVID-19, the ACU triage nurse completes full triage in the ACU-1 anteroom. If they meet exclusion criteria for ACU care, a triage flow nurse is alerted to prepare a private (ideally negative pressure) room for the patient in the main ED. The patient receives an additional blue wristband indicating they have been cleared to enter the main ED. Exclusion criteria are as follows:

1. Highest risk medical conditions (left ventricular assist device, pulmonary hypertension on Flolan infusion, cystic fibrosis).
2. Immune compromised (neutropenic, active chemotherapy, solid organ transplant).
3. Behaviour risk/psychiatric hold/altered mental status.
4. Vital signs (systolic BP <90, respiratory distress, hypoxia <92%).
5. Pregnant.
6. Non-ambulatory even with assistance.
7. Known to be COVID positive.

Patients deemed appropriate for the ACU are then triaged into ACU-1 or ACU-2. ACU-1 is a rapid treat and release unit for patients who need minimal workup and intervention without an assigned nurse. This is staffed by either an APP or attending physician with access to COVID-19 swabbing, EKG, portable X-ray and oral or inhaled medications. ACU-2 can accommodate eight patient trolleys and is designed for patients who need more interventions (eg, intravenous fluids, intravenous antibiotics) and possible hospital admission. ACU-2 is staffed by an APP or attending physician as well as up to two dedicated RNs. This flow is displayed in figure 3.

### CHALLENGES, LESSONS LEARNT AND NEXT STEPS

The rapid implementation of dedicated COVID-19 surge units adjacent to our ED posed challenges that were overcome through health system collaboration, adaptation of existing resources and embracing continuous process improvement. We share the details and logistics of our journey as one approach, recognising that no two clinical settings are identical.



**Figure 2** Photograph of rapid triage station.

An early barrier to implementation was a concern that because our ACUs are structures located outside our main ED, the care would be viewed as substandard. It was also thought that staff dressed in full PPE operating out of 'tents in a parking lot' would raise fears among patients about entering this care area. We chose an acceptable name for our tents as 'Accelerated Care Units' and gave ACU tours to our hospital leadership prior to opening. In-person demonstrations of workflows let our leadership see that high-quality care could be achieved in these units. In addition, because we were the first ED in San Francisco to erect such structures, the media were interested and provided positive publicity.

Some keys to our successful implementation warrant highlighting. First, engagement and commitment from health system leadership is critical. EDs that either choose to or are forced to 'go it alone' are likely to face more challenges

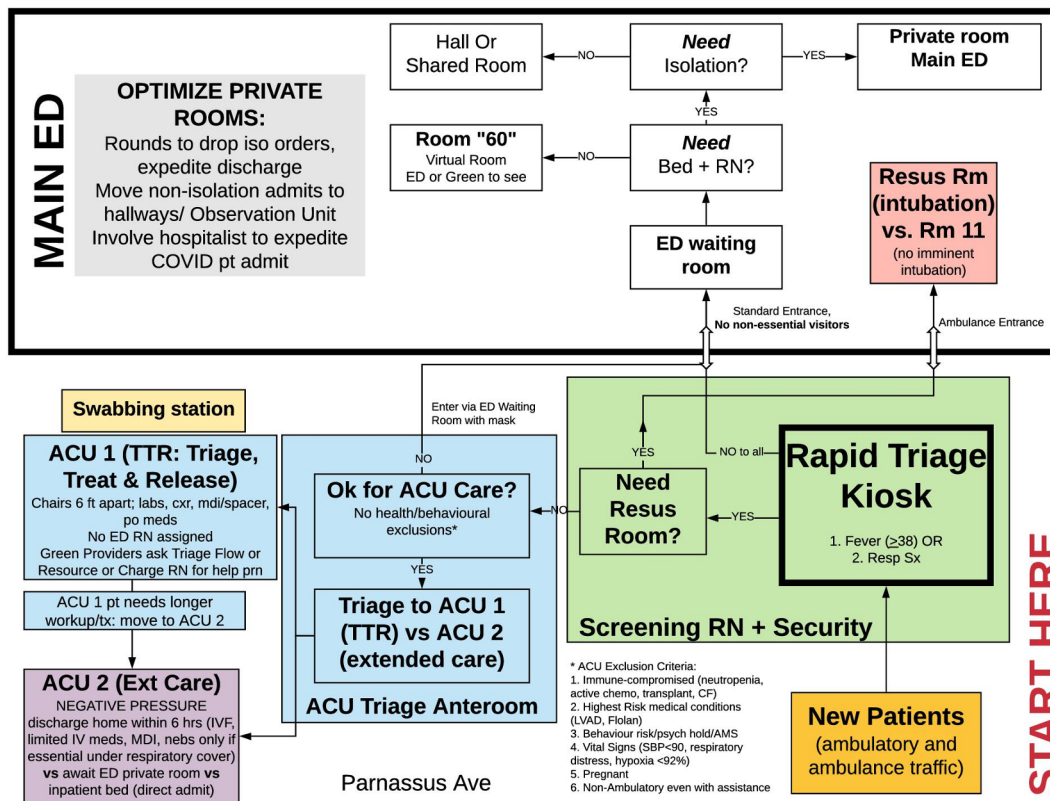
than those who have both financial and logistical support from executive teams. EDs should be prepared to report on metrics, staffing needs and workflows to ensure that other clinical and non-clinical partners understand the role of the ED in supporting the health system every day, as well as during pandemics or other disasters.

Second, creative and flexible staffing is especially important when planning to respond to COVID-19-related surge. Rather than increase staff right away, we altered our existing workflow to adapt to the ACUs, providing us time to directly observe our true staffing needs and increase only during times of substantial surge. Implementation of remote provider capabilities and telehealth have served to further extend our workforce capabilities.

Third, open and accessible communication is key to staff engagement and successful implementation. A single platform for providers and staff that is

continuously updated to provide the most current COVID-19 policies and protocols has been essential. In addition, having a dedicated ED COVID attending has assured that our providers and staff have a 'go-to' person for all COVID-19 issues and questions that arise on a daily basis. This role also provides an additional layer of security that our staff and providers are practising according to the most current standards.

Our leadership team continues to look towards next steps for our COVID-19 response. First, with the help of added staffing and telemedicine, we have the ability to provide care in the ACUs up to 24 hours a day if needed. However, the ACUs are optimized for lower acuity ambulatory patients. To address overall ED capacity, including complex and critical care patients, the ED is working with our health system to develop a comprehensive medical centre-wide surge plan. Given the early shelter-in-place issued in



**Figure 3** Diagram displaying patient flow from rapid triage to discharge. ACU, accelerated care unit; AMS, altered mental status; CF, cystic fibrosis; IVF, intravenous fluids; LVAD, left ventricular assist device; MDI, metered dose inhaler; RN, registered nurse; SBP, systolic BP.

San Francisco, we have benefited from a significantly ‘flattened curve’ in the San Francisco area. Given the fluid nature of this pandemic and the likelihood that COVID-19 will remain a significant public health threat for many months, we will leave our ACUs in place for the foreseeable future, serving as respiratory isolation units during periods of surge and repurposing this space for low-acuity non-respiratory patients between surge periods. This will allow us to remain prepared to respond to sudden increases in patient volume at a moment’s notice with minimal waste of resources.

The processes outlined here are not static and will continue to be adapted as we confront our full COVID-19 surge. The guiding principles of what we have outlined, however, should remain useful

and relevant for the remainder of this crisis and leave us more prepared and resilient for the next inevitable disaster, pandemic or surge that our ED must tackle.

**Contributors** All authors were involved in the original planning of the ACUs, and in the composition and editing of the manuscript.

**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not required.

**Provenance and peer review** Not commissioned; internally peer reviewed.

This article is made freely available for use in accordance with BMJ’s website terms and conditions

for the duration of the covid-19 pandemic or until otherwise determined by BMJ. You may use, download and print the article for any lawful, non-commercial purpose (including text and data mining) provided that all copyright notices and trade marks are retained.

© Author(s) (or their employer(s)) 2020. No commercial re-use. See rights and permissions. Published by BMJ.



**To cite** Noble J, Degeysy NF, Kwan E, *et al.* *Emerg Med J* 2020;**37**:402–406.

Received 16 April 2020  
Revised 30 April 2020  
Accepted 8 May 2020  
Published Online First 27 May 2020

*Emerg Med J* 2020;**37**:402–406.  
doi:10.1136/emered-2020-209788

**ORCID iD**  
Cortlyn Brown <http://orcid.org/0000-0002-1844-0624>