From Concerts to COVID: Transforming the RI Convention Center into an Alternate Hospital Site in under a Month

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ABSTRACT

Field hospitals have long been used to extend health care capabilities in times of crisis. In response to the pandemic and an anticipated surge in patients, Rhode Island Gov. Gina Raimondo announced a plan to create three field hospitals, or "alternate hospital sites" (AHS), totaling 1,000 beds, in order to expand the state's hospital capacity. Following China's Fangcang shelter hospital model, the Lifespan AHS (LAHS) planning group attempted to identify existing public venues that could support rapid conversion to a site for large numbers of patients at a reasonable cost. After discussions with many stakeholders – pharmacy, laboratory, healthcare providers, security, emergency medical services, and infection control – design and equipment recommendations were given to the architects during daily teleconferencing and site visits.

Specific patient criteria for the LAHS were established, staffing was prioritized, and clinical protocols were designed to facilitate care. Simulations using 4 different scenarios were practiced in order to assure proper patient care and flow, pharmacy utilization, and staffing.

KEYWORDS: disaster preparedness, COVID-19, EMS, operations, surge

BACKGROUND

Field hospitals have long been used to extend health care capabilities in times of crisis. In the American Civil War, field hospitals were used to provide solace and comfort, as well as limited care to (often mortally) wounded soldiers. During the 1918-1919 influenza pandemic, field hospitals played an important role in extending care beyond the limited capacity of the nation's hospitals. As the city of Providence braced for a surge of patients, Rhode Island Hospital added 75 beds, Saint Joseph's Hospital added 25 beds, and the former Hope Hospital, a specialty surgical facility, provided its nurses' home and billiard room for emergency care.[1] Emergency hospitals opened in Pawtucket, Woonsocket, Westerly, and Warwick.[2]

In December 2019, the first case of the novel coronavirus, SARS-CoV-2, known as COVID-19, was detected in Wuhan, China. Soon after, on Jan. 19, 2020, the first case of COVID-19 was reported in the United States in Snohomish County, Washington.[3] By the first week of March, there were nearly 110,000 cases of COVID-19 globally and nearly 600 cases in the United States.[4] At that time, there were still no documented cases of COVID-19 in Rhode Island (RI).[5] In response to the pandemic and an anticipated surge in patients, RI Gov. Gina Raimondo announced a plan to create three field hospitals, or "alternate hospital sites" (AHS), totaling 1,000 beds, in order to expand the state's hospital capacity.

On March 9, 2020, Gov. Raimondo signed Executive Order 20-02 directing the Rhode Island Emergency Management Agency (RIEMA) to activate the state emergency operations center, establish mobile support units, and deploy disaster teams.[6] One month later, Executive Order 20-21 was signed mandating the expansion of hospital capacity including "constructing and operating alternative hospital sites." The Rhode Island Convention Center (RICC) was identified as the Lifespan site, while the former Citizens Bank operations center in Cranston and the former Lowe's store in North Kingstown were utilized by the Care New England Health System.[7] Lifespan, the state's largest health care system, was given the task of creating a 600-bed AHS on March 28.

Erecting an AHS is no small feat, requiring the assistance and input of many. This article seeks to highlight components of the planning and execution involved in transforming the RICC into an AHS offering COVID-19 specific, hospital level care.

IDENTIFYING A SITE

Alternate hospitals have been created in all settings including fields, gymnasiums and conference rooms, but the challenge of needing to house up to 600 patients for an extended period made the more traditional field hospital approaches (i.e. tents and cots) less than ideal. The issue of where to establish such a facility without breaking ground on a brand-new structure presented a unique challenge in a small state. China's Fangcang shelter hospitals, created in response to the COVID-19 pandemic, were temporary hospitals converted from existing public venues to care for patients with mild to moderate disease. Following the Fangcang shelter hospital model, the Lifespan AHS (LAHS) planning group attempted to identify existing public venues that could support rapid conversion to a site for large numbers of patients at a reasonable cost.[8] Factors such as water and sewer capacity in

addition to the ability to deliver an oxygen supply to each bed were unique considerations in site identification.

The final determination of the LAHS was decided by the Governor's office with input from RIEMA, the RI Air National Guard (RIANG), and various consulting groups. Considering the state's largest hospital, Rhode Island Hospital, has only 719 beds, the decision to create 600 additional beds at an alternative site would require a significant amount of space. Identifying an existing venue that would allow for such capacity quickly narrowed down the options. The RICC was selected for its central location, size, easy access and egress, proximity to two acute care hospitals with ICU and surgical capacity, as well as an established relationship with local public safety agencies.

CONSTRUCTION

Design was the first step. By decree of the Governor, RIANG was tasked with overseeing the construction of the facility and providing logistical support. The state contracted with an infrastructure firm, which, in turn, sub-contracted the architectural and construction work. Many RI companies were used as subcontractors during the building process, providing jobs at a time where unemployment in the state was at a record high.

After discussions with many stakeholders, including pharmacy, laboratory, healthcare providers, security, emergency medical services, and infection control, design recommendations were given to the architects during daily teleconferencing and site visits (which were limited in space and time to respect social distancing measures). Ingress and egress, modifications to registration rooms, ward patient bays, and resuscitation pod designs were created after these feedback sessions. Actual construction took 13 days. While the RICC had excellent infrastructure, certain modifications needed to be made. Three industrial fans were installed on the roof and connected to large ducts in the facility to engineer a negative pressure environment in the clinical care area (**Figure 1**). Plumbing was installed to existing conduits for sinks. The loading docks were segregated into hot and cold zones for infection prevention; donning and doffing zones were created at entrance points to the clinical care areas, and pharmacy and lab services were isolated in the cold zones with a transition zone for handoff of materials. Bathrooms were modified to include showers.

INFECTION CONTROL

Emergency response to hazardous events dictate the division of areas based upon potential for exposure; these are

Figure 1. Clinical care area [PHOTOS: SELIM SUNER, MD]

Figure 2a. Handwashing stations

Figure 2b. Resuscitation room

commonly termed as "hot" (area with highest concern for exposure), "warm" (transition area), and "cold" (clean and without potential for contamination).[9] Since this AHS would house large numbers of infectious patients, zones with these distinctions were established to aid in the determination of medical personnel exposure risk. Any area where a patient would be while receiving care in the facility or where a patient would be entering or exiting the facility was designated as hot. This area was continuous and was surrounded by warm zones. Three large access points to the hot zone were chosen for the donning and doffing of personal protective equipment. This was based upon the need for larger numbers of staff to enter and exit together during change of shift. There was also a donning and doffing station placed just before staff bathrooms that was accessible from the hot zone, and a small station where ambulance patients would be leaving the hot zone. While ideal planning would have allowed for full decontamination on site (e.g. staff showers), facility limitations prevented this from being established. It was also determined that the risk to providers from incidental contact with the pathogen was low enough that offsite decontamination was reasonable. Changing areas were provided to allow for removal of clothing worn in the hot zone, and ample hand sanitation stations were available for additional hygiene measures (**Figure 2a**). The process of providing patient nutrition was also evaluated. Food for both patients and providers were prepared in the same cold zone, and then transported to different areas, with staff eating in a cold zone cafeteria, and patient food being transferred to the hot zone via a warm zone created by a two-layered door. Similarly, pharmacy developed hand-off procedures. Most medication preparation was to occur in a cold pharmacy and handed through a double-closed passage into the hot zone, creating a warm zone in between. Time sensitive medications needed in the event of resuscitation were kept in an Omnicell in the resuscitation room in the hot zone. (**Figure 2b**).

DEFINING THE PATIENT POPULATION

Globally, some of the alternative hospital sites were designed to provide additional intensive care unit (ICU) level facilities for the increased number of mechanically ventilated patients or designed to manage non-COVID-19 patient populations. However, the LAHS was designed to extend inpatient capacity for patients with COVID-19; the primary objective was to move floor-level patients from inpatient units, allowing the ICUs to expand into medical floors, rather than staffing and equipping a standalone ICU at the AHS. This, in turn, made regular floor space in the hospitals a premium. The LAHS was designed with the intent to not make this a fully functioning hospital, rather, to extend inpatient capacity in the disaster setting. For this reason, inclusion criteria was limited to patients that were between the ages of 18 and 65, had a laboratory confirmed or clinical diagnosis of COVID-19, were experiencing continued shortness of breath but had a pulse oximetry reading >92%, had a non-dynamic or non-ischemic appearing electrocardiogram, and were

exhibiting signs and symptoms meeting criteria for observation or inpatient hospital level of care. As the site was not fully capable of providing all hospital services such as imaging and escalation to ICU level of care, the very young, pregnant, those requiring more frequent evaluation, and those experiencing significant respiratory distress would be excluded from admission to the AHS.

Patients requiring imaging (plain X-ray or computerized tomography) or specialty services could be transported to a Lifespan hospital and returned to the AHS or be admitted to a Lifespan hospital if their condition required inpatient care. Patients could be directly admitted from local emergency departments or be transferred from Lifespan hospitals and other community facilities as long as they met LAHS admission criteria. Provisions were made to serve the diversity of our local population with availability of translator services, social services, and discharge instructions in the most commonly spoken languages.

STAFFING

A 2017 Prehospital and Disaster Medicine article found that healthcare providers may not be fully prepared for disasters.[10] With this knowledge in mind, along with an anticipated shortage of extra acute care providers (emergency medicine and critical care) due to their "home hospital" commitments, the decision was made to create a hybrid staff of acute care providers along with others from specialties whose practices were closed or operating at a minimal capacity. Acute care physicians were deployed as facility leaders available for the acutely decompensating or complex patients, while providers volunteered from many other specialties around the state and within Lifespan to staff the LAHS. While 600 beds were created at the LAHS, approximately 25 separate pods of 24 patients each were to be staffed by 1 attending physician or advanced practice provider and 2 nurses. A separate 12-bed area was created as a transition zone affording a higher level of care for patients requiring transfer to a hospital.

Nursing staff were recruited with the express goal of finding experienced nurses specializing in emergency or critical care medicine, while not straining staffing resources already committed to local hospitals. Emergency medical technicians were recruited to assist in monitoring staff members for symptoms prior to entering the facility as well as to respond to emergencies within the facility. Paramedics were deployed to evaluate patients transferring into the facility and to treat those patients needing a higher level of care in the resuscitation area, alongside the acute care physician. Fourth-year medical students were awarded early graduation and volunteered to work in the LAHS as newly minted doctors.

CLINICAL PROTOCOL DEVELOPMENT

Clinical protocols were developed for (1) COVID-19 general management; (2) emergency management of decompensating patients; (3) evaluation of new symptoms (e.g., chest pain); and (4) management in the event of a staff member illness. Protocols were adapted from current standard care in the parent hospital system (Lifespan) and were based on expert consensus, recommendations from the Centers for Disease Control and Prevention, and professional society guidelines. In addition, protocols were aimed at creating simple, easy-to-follow guides for the rapid identification and initial management of life- or limb-threatening emergencies by non-emergency trained providers until the patient could be moved to the resuscitation area for care by an acute care physician. Procedures for rapid specialty consultation (e.g., cardiology, infectious disease) were also developed, should the need arise. Protocols ultimately were a hybrid of in-hospital and pre-hospital emergency medical services (EMS) style algorithms. Examples may be seen in **Figure 3**.

Figure 3. Protocol examples

Acute Change in Neuro Status (including seizures)

1. Ensure airway protection; position in left lateral recumbent position as needed
2. If concern for acute psychiatric illness, ensure staff, patient and bystander safety.
3. Check glucose
4. Consider a trial of naloxone if there is respiratory depression AND concern for opioid overdose
5. Perform brief neurological exam to evaluate for focal deficit
6. Obtain 12-lead EKG

Hypoglycemia

1. Encourage PO and recheck glucose after 5 minutes
2. If unable to tolerate PO, administer D10 wide open until mental status improves
3. Once mental staus improves, encourage PO intake
4. Recheck q15 minutes glucose x 3 after resolution of symptoms to ensure stability

Intractable Nausea/Vomiting

1. Administer 4mg PO ondansetron ODT (if no h/o prolonged QTc)
2. Consider administration of additional 4mg of IV ondansetron PRN
3. If no response to ondansetron, consider alternatives (prochlorperazine, metoclopramide)
4. Evaluate for other causes of N/V including MI, bowel obstruction, etc.
5. IVF bolus for persistent symptoms

EQUIPMENT & INVENTORY

Medical equipment, supplies, and medication needed for the facility were determined by the planning group with the help of pharmacists, physicians, and nurses from key specialties. The final list reflected medications required for the stabilization of critical and acutely decompensating

patients prior to transfer to the hospital. Some of the determinations made in this planning process included keeping the minimum necessary equipment for stabilization prior to transfer to a standard emergency department (ED) without overwhelming staff with infrequently used items. The focus was on having equipment available to treat immediately life-threatening conditions and performing stabilizing procedures rather than definitive management. For example, it was determined that thoracostomy tubes would likely not be needed since a tension pneumothorax would be a rare event in this population, and rapid interventions such as needle decompression or finger thoracostomy could replace the need for this time- and equipment-intensive procedure.

A handheld point-of-care ultrasound machine was also obtained for use by the acute care physicians in the resuscitation area in place of typical ED and ICU portable (X-ray) and nonportable (computed tomography) imaging equipment. A complete inventory list was assembled and reviewed by members of the team and procured with state assistance.

USE OF SIMULATION TO TRIAL PROTOCOLS

A systems-based evaluation leveraged high-fidelity simulations of common patient-care scenarios and high-risk, low-frequency events. These onsite simulations were facilitated by the Lifespan Medical Simulation Center during a four-hour session. Following each scenario, a debriefing session was held to solicit feedback and potential modifications in clinical protocols or equipment needed. More than 30 individuals representing various stakeholder groups were present. Two notable changes that came from this session included: a change in the medication stored in the resuscitation room (from intubation-focused to resuscitation-focused), and the addition of an extra donning and doffing station adjacent to the ambulance egress from the hot zone in the event a LAHS staff member required transfer to a hospital.

COMMUNITY COLLABORATION, SECURITY, AND EMERGENCY MEDICAL SERVICES

As the LAHS was not meant to function as a full hospital, plans for transfer to local hospitals were of the utmost importance. In collaboration with multiple RI EMS agencies including LifePact Critical Care Transport and the Providence Fire Department, plans were established for transfer of patients into the LAHS, transfers to higher level care, and discharge from the LAHS. Communication was established with EMS agencies, acute care hospitals, and urgent care centers regarding inclusion and exclusion criteria for patients cared for in the LAHS and transfer protocols. The Lifespan Communications Center and ExpressCare (an inter-hospital emergency care referral center) played an integral role in the coordination of patient transfers in and out of the LAHS.

Fire safety and security were an important concern as historically, field hospitals have been targets of violence. Since the September 11, 2001 terrorist attacks, hospitals have been thought of as ideal, soft targets for terrorist threats – both organized and "lone wolf" type attacks.[11,12, 13]

In order to ensure safe operations at the LAHS, this massive undertaking required the cooperation of multiple agencies including the RIANG, State Police, Providence Police Department, Providence Fire Department, State Fire Marshal's Office, and Lifespan Hospital Security. RIANG facilitated tabletop exercises in order to identify risk and hazards and possible mitigation measures.

CONCLUSION

The decision to expand the state hospital-bed capacity by construction of alternate sites was based on predictive models which signaled a deficit of beds during the height of the pandemic. By use of public health measures such as distancing, isolation, closure of schools and non-essential businesses, increased testing, contact tracing, and isolation of individuals who test positive for SARS CoV-2, the surge was blunted significantly in Rhode Island. Though the LAHS has yet to care for patients, the additional time allowed for more planning and fine-tuning of protocols. This issue is not unique to RI, however. Multiple field hospitals throughout the nation have been built and remained empty or minimally used, including several facilities in New York, Colorado, Illinois, Wisconsin, and Michigan.[14] The LAHS will remain intact through 2020. As many hospitals throughout the state reached 90% capacity during the spring and with community spread still a threat, the state stands prepared for an expected "second wave."

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