## HEALTHCARE **FACILITIES:** SENSIBLE SOLUTIONS TO REAL EMERGENCY SITUATIONS





How should we design for **healing** in response to emergency situations?





## Thank You

NELSON Worldwide sends our sincere gratitude to the millions of front-line healthcare workers around the world delivering excellent care to our families, friends, and neighbors not just in this extraordinary time, but at all times. We are proud to work alongside so many exceptional healthcare systems across the country. The work you do inspires us daily, and we look forward to helping each of our clients further realize their mission in the months and years ahead.

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## Emergency Preparedness From the Outside In

The COVID-19 pandemic continues to put healthcare systems around the world to the ultimate test. From staffing to equipment to facilities, hospitals have bravely and expertly maximized their resources – managing surge capacities, delivering acute and critical care, and doing more with less in a remarkably short period of time. As every day yields new lessons learned, the pandemic challenges us to identify and respond to potential vulnerabilities going forward.

In an era of accelerating climate change, severe weather events, and the threat of terrorist acts, right now is a valuable moment for the design world to listen, observe, innovate, and propose strategies that healthcare systems can use to protect their staff and patients in future crisis situations.

NELSON Worldwide convened some of our healthcare design experts from across the firm to think about emergency response from the outside in. From ambulance traffic flow to the layout of handwashing stations, we took a holistic view of crisis preparedness in the built environment to recommend sensible solutions that are applicable for both today's and tomorrow's public health emergencies.



# Hospital Site Opportunities

In preparing for mass public health emergencies, hospitals and healthcare facilities must start with the big picture and consider a comprehensive site review. Spikes in ambulance traffic and overall demand for access are inevitable. Planning that eases navigation, streamlines circulation and traffic flow, and clarifies logistics connected to the hospital site will allow staff to carry out their duties more smoothly and ease the burdens of a surge in demand for care.









## SITE DECONGESTION AND ACCESS CLARITY

Removing excess barriers and allowing room for a surge in traffic and activity is of utmost importance in preparing your site for a mass emergency.

- > Clearly designate access points and separate traffic flows.
- > Create a traffic flow plan that minimizes crossings and keeps all services moving.
- > Create an emergency circulation plan that can be quickly enacted.

## **PUBLIC ACCESS**

The public can be the biggest source of congestion since they may be less familiar with your site. In a pandemic, all members of the public must also be treated as potentially contaminated.

- > Clearly mark access points leading into the site to control flow of visitors.
- > Limits points of entry for the public.
- > Set up a vestibule or airlock at entry points to allow for screening of visitors.
- > Set up areas for private consultation within these entry points to accommodate sensitive conversations.

## **EMERGENCY DEPARTMENT ACCESS**

Public demand for access to EDs will increase in a mass emergency. Planning to safely control and triage patients will help minimize congestion.

- > Indoor triage/screening areas will require isolation from the main ED triage area.
- easier. Structures can be connected to the ED entrance or separate.
- > Carefully plan for a controlled flow of patients from these entry points, allowing for safe distancing and segregation by medical issue.
- > Set up areas for private consultation.
- > Consider parking logistics and plan for decongestion.

> If necessary, extend your triage/screening area to the outside, where infection control can be

> Ensure that temporary structures such as tents have adequate utility and sanitary connections.





## **AMBULANCE TRAFFIC CONTINGENCY**

Planning for a surge in ambulance traffic is key to safe accommodation of all incoming emergency patients.

- plan with local EMTs, police, and ambulance services.
- > Define ingress and egress to site.
- > Expand parking access and patient loading areas if necessary.
- > For patient loading areas, provide privacy and shielding from the public and press.
- > Provide adjacent, private respite areas for EMTs and staff for rest and breaks.

#### **STAFF ACCESS**

Protected and controlled entrances for staff are crucial in getting staff to work as safely as possible.

- alternates are needed.
- > Minimize cross-traffic to eliminate obstacles getting in and out of the facility.
- > Provide sufficient PPE supply and disposal at entrances and exits.
- > Set up outdoor respite areas for staff for rest and breaks.
- > Make access as easy as possible to minimize stress.

Page 5–Image: © Penn Medicine

Page 6–Top Image: © Barry Chin–The Boston Globe/Getty Images Page 6–Bottom Image: © Don Seabrook/Wenatchee World

> Prior to any emergency, healthcare systems should agree to an ambulance contingency

> Establish whether existing protocols for site access and parking are to remain in place or if

This Page—Top Image: © David Ryder/Getty Images This Page–Bottom Image: © Anadolu Agency/Getty Image

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### **ADDITIONAL SITE SERVICES**

Hospital systems must remember to anticipate surge demand for related medical functions on site, including morgue services and materials handling.

- setting up a staging area for refrigerated trucks with access to power.
- > Avoid visual access from nearby streets to protect privacy and dignity.
- > Plan for controlled, protected delivery of clean materials into the facility. Concurrently, assign additional areas for supply storage inside the facility.
- > Designate an area to accommodate an increase in waste materials.

#### MEDIA ACCOMMODATION

In times of crisis, press will be compelled to deliver reports to the public from hospital sites. Planning for regular access will help minimize any burden on hospital operations and logistics.

- > Designate an easy press access point.
- where they can access electrical for their equipment.

> Create an emergency plan for an increase in morgue capacity. Typical solutions have included

> Plan expanded space for medical examiners and funeral home staff to complete pickups.

> Designate a piece of hardscape for press that enables a favorable shot of the hospital and

> Establish a parking or staging area for transmission trucks so as to avoid causing congestion.



# Infection Control

In a pandemic, how do we equip healthcare facilities for the highest level of germ mitigation and infection control? When treating a concentrated population of infected and other vulnerable patients, controlling pathogen spread within hospitals is essential for the safety of all facility inhabitants, from caregivers to visitors.









#### **IMMEDIATE SOLUTIONS**

Quick modifications to space can help bridge the gap between normal operations and surge capacity.

- example, at entrances.

#### LONGER-TERM GOALS

More permanent changes should be considered for the longer term to expand emergency capability.

- PACUs, outpatient areas, etc.
- floor plate.
  - areas of isolation.

  - entrance of cafeterias.

Previous Page–Image: © Ted S. Warren/AP Photo This Page–Image: © Medical Construction & Design

> Set up PPE stations at entrances, elevator lobbies, and corridors.

> Position temporary handwashing sinks throughout the facility, for

> Establish isolated patient care rooms with negative air pressure.

> Create more isolation rooms in all units, from med/surge, ICUs,

> Install operable windows to help with air exhaust

> Compartmentalize zones, which will require a rethinking of the entire

• Work with engineers on a ventilation strategy that works across

• Plan for expanded PPE stations, accessible to staff and public.

• Permanently install more handwashing facilities, such as at

# Flexibility and Surge Capacity

Understanding the range of crisis responses hospital systems can adopt will aid in the organization's decision-making at all scales. Here we survey what flexibility means across different emergency levels and then highlight the most relevant approaches for accommodating COVID-19 surge demand in your facility.

EXI









## WHAT IS A HEALTHCARE SURGE AND WHEN IS IT DECLARED?

States publish guidelines defining public health emergency levels and the protocols to follow in authorizing a range of responses from local to federal. The example below illustrates the California Department of Health's color-coded system for enacting surge response (see below).

	LOCAL SURGE EMERGENCY						
SURGE LEVEL	GREEN	YELLOW	ORANGE	RED	BLACK	REGIONAL LEVEL SURGE	STATEWIDE SURGE LEVEL
ENABLING AUTHORIZATIONS	Regulatory / Accrediting agency waiver	Regulatory / Accrediting agency waiver	Regulatory / Accrediting agency waiver / Local emergency declaration	Local emergency declaration	Local emergency declaration	State of emergency declaration	Federal emergency declaration
SURGE MONITORING GUIDELINES	Usual day to day status; No assistance required	Surge managed locally; No assistance required	Additional healthcare assets required within jurisdiction	Assistance needed outside local jurisdiction or area	Significant assistance needed outside local jurisdiction		

## **HOSPITAL SURGE CATEGORIES**

Hospitals have many factors to consider in planning for surge capacity. These categories encompass some of the most critical factors in emergency preparedness and will have the highest impact on both patient outcomes and staff effectiveness (see graphic at left).

Previous Page—Image: © Benjamin Norman/The New York Times Table Above—Information courtesy of California Department of Public Health

FUNCTIONAL SCENARIOS			SURGE THREAT SCEN			
	PEACETIME	ENDEMIC		PYRAMID CROWDING	REVERSE PYRAMI	
		Dengue		H1N1	SARS	
	Baseline service usage, often operating at maximum capacity	ervice ften g at apacity		Maximum ED crowding but complexity	No ED crowding but complex admissions	
		Spread spiral resilient o contain	ls bi cap ied	eyond adapted acity — not at source	Pathogen mutation spir	

#### SURGE CAPACITY VS. SURGE CAPABILITY

It is important to distinguish between "surge capacity" and "surge capability" to understand the balance hospitals must plan for in a public health emergency. Surge capacity refers to a hospital's ability to manage a rapid increase in volume of patients, while surge capability must complement this, providing for expanded capabilities in treating conditions of unusual acuity or severity. Both surge definitions require operational, staffing, and spatial preparedness.

- > **Surge Capacity:** The ability to manage increased patient care volume that otherwise would severely challenge or exceed the existing medical infrastructure (Barbera and Macintyre).
- Surge Capability: The ability to manage patients requiring unusual or very specialized medical evaluation and intervention, often for uncommon medical conditions (Barbera and Macintyre).

#### **FUNCTIONAL SCENARIOS**

Planning for flexibility requires consideration of the start state and the end state of an emergency scenario. Functional scenarios built around information we have on current and historical pandemics or other public health events can help us understand the nuances around which areas—operational, spatial, etc.—need additional prepping for capacity or capability—for example, if the ED can remain functioning at normal capacity, but additional capability is needed to handle more complex triage/ admissions. Through these scenarios, hospitals can begin to build a response strategy.

## ARIOS

)	BLACK					
	Spanish Flu					
	Maximum ED crowding & complex admissions					
als						
l is not contained						

## TYPES OF FLEXIBILITY

ADAPTABILITY	TRANSFORMABILITY	CONVERTIBILITY		
No construction, multiple uses for single space	<b>01. Moveable</b> Can be relocated <b>02. Responsive</b> Surge	Construction involved, time considerations		
Example: Double-gas trauma or emergency rooms can be quickly adapted to treat two patients at once.	Example: ED overflow space in a corridor	Example: Acuity conversions, such as changing a med/surge room to an ICU room		

## SCALES OF FLEXIBILITY

	ADAPTABILITY		TRANSFORMABILITY			CONVERTIBILITY	
Site / Campus		SURGE					
Building							
Department					CLU		
Room					501	(GE	
Object							

### **TYPES OF FLEXIBILITY ACROSS SCALES**

Different types of flexibility are appropriate for different surge scenarios. Adaptable **spaces** can be planned for easy, short-term changes that require no construction in response to an immediate or urgent scenario. **Transformable spaces** are movable and responsive to surge events. **Convertible spaces** require construction and must take into account longer time frames for completion (see top table).

Right now, in response to COVID-19, we are seeing adaptable and transformable spaces being utilized to response to surge across all scales, from buildings to objects. Convertible solutions are being used for hospital departments and patient rooms, but because of time constraints, larger-scale convertibility is more difficult to achieve.

#### SURGE SOLUTIONS FOR YOUR FACILITY

Across scales and different types of flexibility, what kinds of solutions can accommodate surge in your facility? For COVID-19, we have identified the most relevant areas of the hospital, along with potential off-site solutions, for flexibility planning (see bottom table).





#### **PATIENT ROOMS**

Early-stage patient room infrastructure planning can offer a range of efficient and flexible options in surge situations. Some approaches include:

- one patient (see images to left).
- services to be added, removed, or moved around for more capacity and flexibility.
- isolation/infection control (see image below).



Top Left Image: © Texoma Medical Center Bottom Left Image: © Medical Construction & Design Image Above: Omniaire OA2000VM-706 Medical Grade HEPA Negative Air Machine

> Headwall configurations: include multiple or lateral services to accommodate more than

> Modular headwall systems tapped in from the ceiling and not fixed within the walls allow

> Adaptable ventilation: use a partially operable window in conjunction with a small HEPA filtration machine to create negative pressure that exhausts directly to the exterior for







### **EMERGENCY DEPARTMENTS**

EDs offer multiple opportunities for accommodating surge situations.

- > Including multiple, lateral services in the headwalls of rooms or treatment bays will accommodate a patient surge (see image at top).
- possibility for treatment of additional patients (see image at bottom right of grid).
- > Establish hallway overflow zones with clear separation of stretchers and foot traffic (see image at bottom left of grid).



Top Left Image: © MJP Architects– St. Vincent Medical Center Bottom Left Image: © Paul Chiasson/Canadian Press Bottom Right Image: © Kearney County Health Services Image Above: DiaMedical Headwall

> Trauma rooms have additional services setups and larger space for surgery, etc., opening the

> Compact modular headwall systems can be used in atypical spaces in times of surge (see below).











### **PRE-AND POST-OPERATIVE UNITS**

As it is typical for hospitals to cancel or postpone elective surgeries during a mass emergency situation, pre- and post-op spaces offer further options for accommodating surge capacity (see top two images).

### **CONVERSION OF ON- AND OFF-SITE SPACES**

We have seen conversions of everything from large convention centers to hockey arenas to vacant hospitals for COVID-19 patient overflow in locations across the world. Hospitals are also converting soft spaces, such as conference rooms, with simple treatment bays for low-acuity patients, allowing more patient rooms to be freed for use (see bottom four images).

Top Left Image: © Surgery Center of Viera Top Right Image: © Getty Images Middle Left Image: © Cleveland Clinic

> Treatment bays can be used for low-acuity clinical patients to open up other patient rooms for use.

> Pre- and post-op units are already prepared with both space and staff for changing circumstances.

Middle Right Image: © AFP/Getty Images Bottom Left Image: © New York National Guard/Flickr Bottom Right Image: © Walsh Construction

# Modular Solutions for Surge Demand

We have seen that hospitals have many options for site and facility modifications to accommodate surge demand. But when patient demand exceeds a hospital system's full, extended capacity, we need external space options that are quickly and simply assembled to accommodate overflow. Here we highlight some current concepts in use or development.









### MOBILE, MODULAR MATERIALS

Shipping containers are now a broadly used material for a variety of building types, from housing to healthcare environments. They offer cost-effective, easy, and quick assembly. For COVID-19, shipping containers can be used as single-support rooms or joined together as functioning field hospitals. They can also be incorporated in mobile testing centers, labs, and treatment centers (see top image).

#### THE "SMART" MODULAR PATIENT ROOM

EIR Healthcare has taken that idea one step further, developing their MedModular fully functioning patient room. The room is prefabricated from sourced components, including antimicrobial surfaces. Intelligent data systems provide all patient monitoring and communication information, including facilities management of the environmental systems. These units can be combined to form a micro-hospital, critical access hospital, or other facilities to be scaled up or down as needed (see bottom image).

Top Image: Modular Camp by DSL & Marco Cappelletti Previous Page and Bottom Image: MedModular Patient Room by EIR Healthcare

# Patient, Family, and Caregiver Wellness in a Crisis

COVID-19 has been a stark reminder of how much stress our caregivers are asked to handle in a public health crisis. The physical and mental toll of long shifts, heavy PPE, and caring for distressed patients must not be forgotten in an effective emergency response strategy. The experience of patients and families coping with what can be a frightening and severe illness is also a mandate for thoughtful solutions that support calm and healing environments. How can hospital design attend to wellness in a state of crisis?





#### TRADITIONAL

#### **DESIGN FOR WELLNESS**

#### **CAREGIVER WELLNESS**

The demand of long shifts necessitates adequate and smartly placed respite space. Oftentimes, respite space is treated as an afterthought and located in areas disconnected from main treatment space. Dedicating larger space for rest, connected to nursing stations and other areas adjacent to normal workflow can create a more convenient break option for caregivers. Restful furnishings, ample daylight exposure, and calming colors are all proven to promote stress relief. Space options include:

- > Rooms and alcoves located off corridors.
- > Spaces with sightlines to patients.
- > Outdoor spaces such as roof gardens.

Previous Page-Image: © Scott Webb/Unsplash Floor Plans: © NELSON Worldwide Bottom Left Image: Miami Cancer Institute Baptist Health South Florida, project by NELSON Worldwide

Bottom Right Image: Yale University Smilow Cancer Hospital, New Haven, Connecticut





Above Image: © Todd Bigelow

Floor Plans: © NELSON Worldwide

Image Grid Top Right All Images: © Steelcase





#### FAMILY WELLNESS

Hospital waiting rooms are notorious for overcrowding (see image at top left). In a public health crisis, this can induce more stress as well as jeopardize infection control. Hospitals can explore decentralized plans to ease crowding. Strategies include:

- > Disperse sub-waiting areas throughout the floor plan (see plans to left).
- > Linear seating along corridors for flexible wait space.
- > Create sub-waiting areas for specialty clinics.
- system can help reduce crowding.

Hospitals with large waiting rooms can create smaller, contained sub-sections with dispersed furniture to accommodate families with safe distance in between (see image grid at top right).

> When space allows, immediately move families into triage areas to reduce load in waiting areas.

> Telehealth options, including video appointments, app assistance with registration, or a pager





#### **PATIENT WELLNESS**

Patient safety is always top priority, but in responding to a highly infectious disease, germ control is paramount. Rigorous cleaning protocols with harsh products can be impractical to sustain and ultimately harmful in encouraging antibiotic-resistant bacteria.

Fortunately, many advances in naturally anti-microbial materials will enable hospitals to fight more sustainably against viral spread. Although upfront costs for these materials may seem high, considering that the cost of hospital-acquired infections is \$147 billion and 100,000 deaths yearly, the ROI of these materials is clear. Some of these include:

- variety of finishes in a space, from countertops to over-bed tables to IV poles.
- up to four years after application.
- as elevator buttons, switches, and handrails, in addition to HVAC filters.
- pathogens over an eight-hour period.

Top Image: © lolostock/iStock Bottom Image: © Sun Valley Bronze

> Copper naturally kills SARS-CoV-2 in four hours vs. 72 hours on plastic and can be used in a

> Paint with microbe shields can quickly kill common pathogens such as staph, MRSA, and E. coli

> Silver ion technology can be used in coatings and polymers applied to common surfaces such

> Germicidal UV lighting is now safe for human exposure and eliminates 99.7% of common



# Sensible Solutions to Real Emergency Situations

COVID-19 has served as a worldwide wake-up call to challenge the status quo and embrace forward-thinking solutions that enhance emergency preparedness. The lessons we learn from this pandemic should serve as the foundation for crisis mitigation strategy in the future. From site modifications to patient room design and material selections, hospitals can work with designers to create environments that serve as formidable tools in the fight against infection and the protection of patients, families, and healthcare professionals. N

## About NELSON

NELSON is an integrated architecture, design, and strategy firm. We believe that compelling human environments should be informed by deep insight and knowledge of our clients' businesses, brands, competition, and users. We address our clients' challenges with ingenuity to provide unexpected approaches and solutions. And most importantly, we are driven by results. Our vision is to become a partner, beyond just a project.

NELSON's healthcare practice has delivered intelligent planning and design solutions to healthcare systems for over 40 years. We put the patient and staff experience at the center of the process, collaborating closely with all stakeholders to promote comfort, efficiency, and safety across healing environments at all scales.



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Are you looking for sensible solutions to better serve patients, caregivers, and communities? Our team of experts bring decades of experience in transforming healthcare environments and planning for emergency preparedness.

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