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Infectious Pandemic Surge Program - ICU

Written By: Susan Ealer



Introduction

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Why The ICU?

ICU Unit

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Hospital

Space Program

Introduction

'Stay Safe' - the new salutation.



Introduction

Testimonial:

"I don't want to go to the hospital because I'm going to die there." That's what I told my husband as I lay on my side next to the humidifier trying to breathe with my heart racing. It was late March 2020 and the pandemic had just bloomed in New York City. I had continued walking blithely through the streets without a mask because masks were deemed "ineffective." I called my doctor for an asthma inhaler refill and hung up with a clinically diagnosed case of COVID-19 and an order to stay in my room. So, to say I "told" my husband I was terrified to go to the hospital probably meant I texted him or shouted it at him through the door.

At the height of the surge, The New York Times was my window to the world. I was pulling it up every couple of hours on my phone and the news was frightening. City-wide, 3,500 ICU beds were filled with COVID patients. People being treated in world-class institutions were dying on ventilators. 800 deaths were reported in a single day and morgue trailers were overflowing. The irony that these live-saving institutions had become places to fear and avoid in an emergency is obvious to anyone. To a person who plans hospitals for a living, it was especially disconcerting."

– Author, COVID-19 patient

"I don't want to go to the hospital because I'm going to die there..."

– Author, COVID-19 patient

Introduction

Infectious Pandemic Surge Program - ICU

I am writing this paper to outline an Infectious Pandemic Surge Space and Functional Program for the ICU in response to the great need for Critical Care Pandemic Preparedness that I witnessed every day during the COVID-19 surge here in New York City. The lack of proper facilities and resources to respond to this crisis was something I personally experienced, first as a patient, then as a member of the GYNHA COVID-19 Task Force. As a Medical Planner and Programmer, this is my way of giving back to the physicians, nurses, and other front-line workers who saved our lives.

The first step in planning to fill a need is to find out what that need is. This might seem simple and obvious but in fact, this task is exceedingly difficult. I would argue that this is the most difficult task in planning. First, you have to get all the voices in your head telling you “you know what the need is” to be quiet. Then you have to find it and define it.

When you’re trying to plan for a complex, clinical response to a rapidly spreading Pandemic, which in the current case is caused by an unfamiliar pathogen - the Novel Coronavirus, the task gets exponentially harder. The good news is that I didn’t have to do this all by myself – I had help. Not only is this paper based on my hours of research gathered from official guidelines, task force recommendations, scientific reports, and the work of other people trying to answer the same questions, it is shaped by a series of interviews I conducted with front-line providers, experts, patients, and Perkins&Will healthcare leaders. This is their paper as much as it is mine and I am very grateful for their time and for their contributions.

The second step in planning something is to create something to fill the need. It is my hope that this paper provides helpful, practical recommendations, informed by expert experience and clinical practice. I have focused the study on the simplest module - **an ICU Unit** and, by extension, some of its pieces, like the patient room and elements of the hospital as a whole: patient circulation, waiting rooms, etc.

“I recently did a job for a new client, a nurse. Turns out she was the nurse who took care of my friend when he was dying in the hospital (of COVID-19)...”

- Friend of COVID-19 patient

Contributors



Front-Line Workers

Physicians treating COVID-19 patients
Nurses treating COVID-19 patients
Hospital Department **Directors**



Patients

COVID-19 **Patients**
Friends of COVID-19 patients



Experts

Phil Crompton, Principal, Vantage Technology Consulting Group
Lynne Ingle, RN, former OR Manager, Senior Director Medical Equipment Planning MERC/HLW
Sean O'Neil, Executive Vice President, St. Onge Company

Perkins&Will

Perkins&Will Healthcare Leaders

Jeff Dreesman, Healthcare Practice Leader Western Region
Chisako Fukase, Medical Planner
Anthony Mistretta, RN, MS, HC Ops + Strategic Planning Executive
Chuck Siconolfi, Regional Director, Principal
Marvina Williams, RN, BSN, Senior Medical Planner, Associate Principal

Infectious Pandemic Surge

COVID parade, Torrevieja, Spain.



Infectious Pandemic Surge

Insight:

You don't need a large trigger to set off a large event...imagine a drop of water falling onto a high, knife-edge mountain, If it falls on one side of the ridge, it will flow away...to a deep ocean, if it falls on the other side of the ridge, it will flow into another deep ocean...the two trajectories leading to such different final states may start out infinitesimally close together.

- John Gribbon, Deep Simplicity

Infectious Pandemic - What to Prepare For Next

It's chilling to read the 2017 Johns Hopkins Bloomberg School of Public Health Center for Health Security's paper, *The Characteristics of Pandemic Pathogens*, on the heels of New York City's recent COVID-19 Pandemic Surge. Our Novel Coronavirus checks all the boxes for a GCBR-Level Pandemic Pathogen. **GCBR's are microorganisms (natural or created) that constitute a Global Catastrophic Biological Risk.**

As seen most recently with COVID-19, GCBR's can lead to sudden, extraordinary, widespread disaster beyond the collective capacity of national and international governments and the private sector to control. GCBR's have the capacity to cause great suffering, loss of life, and sustained damage to political and economic infrastructures.

In determining which organisms are likely candidates for GCBR's, it is important not to rely on "historical pathogen list-based approaches," such as creating a list of the "10 worst pandemics of all time." One of the key criteria for a virulent GCBR is that there is no known cure. This would rule out something like the Bubonic Plague, which can now be cured with antibiotics, or even Malaria, which is hypothesized to have killed half of all humans who have ever lived over time.

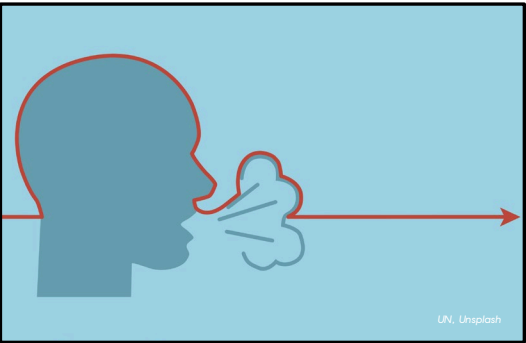
"We went through outbreaks of Ebola and the Measles but we never prepared for anything like this."

- ER Physician on the COVID Pandemic

Infectious Pandemic Surge

*“What is the next thing that’s going to come around? First there was 9-11 with bio-terrorism, then there was Ebola, now **COVID?**” – Marvin Williams, former ED Director, Senior Medical Planner, Associate Principal Perkins&Will*

The most likely candidates for the next pandemic...



Respiratory Transmission (Including During Incubation)

- Influenza A (H7H9)
- Parainfluenza (HPIV)
- Coronavirus/SARS
- Respiratory Syncytial Virus (RSV)
- Enterovirus
- Rhinovirus



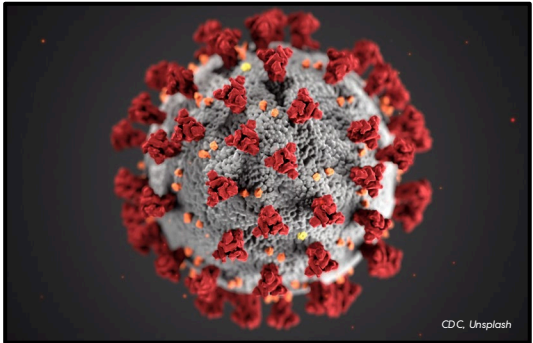
RNA vs. DNA (Less Stable/More Mutation)

- Influenza A (H7H9)
- Parainfluenza (HPIV)
- Coronavirus/SARS
- Respiratory Syncytial Virus (RSV)
- Enterovirus
- Rhinovirus



Absence of Cure

- Influenza A (H7H9)
- Parainfluenza (HPIV)
- Coronavirus/SARS
- Respiratory Syncytial Virus (RSV)
- Enterovirus
- Rhinovirus



Appreciably Fatal

- Influenza A (H7H9)
- Parainfluenza (HPIV)
- Coronavirus/SARS
- Respiratory Syncytial Virus (RSV)
- Enterovirus
- Rhinovirus



Surge - a sudden, unanticipated escalation in health system demand caused by exceptional events.

Case Study: Infectious Pandemic Surge

New York City, COVID-19

Overwhelming Loss Of Life:

Estimates put the number of pre-COVID ICU Beds in New York City at 1600. As of June 28, 2020, the City had 212,000 confirmed cases of COVID-19 and nearly 55,000 patients had been hospitalized. A substantial percentage of these patients required critical care. Lower-income communities were especially afflicted.

As a GCBR-Level Pandemic Pathogen, COVID-19 spread quickly through respiratory transmission during its incubation period in a population with no immunity. Front-line physicians and hospital staff, who had never encountered anything like this before, took heroic measures but were unable to stem the tide of patients dying in their care.

Shortages of Staff/Supplies:

"Hospital leaders estimated that about a third of doctors and nurses were out sick. The hospital temporarily ran out of protective plastic gowns, the main sedative for patients on ventilators, of a key blood pressure medication. The sense of urgency and tragedy was heightened by a video circulating online, showing a forklift hoisting a body into a refrigerated trailer outside the hospital." - Sheri Fink, Code Blue

Equipment/Infrastructure Failures:

Critically ill patients' need for dialysis and for ventilators far exceeded the hospitals' baseline capacities and the available supply chain inventory. Oxygen tanks were strained. One private hospital in the City had to be partially evacuated as its oxygen supply broke down.



Planning For Chaos

'The Universe operates in an irreversible way. You can never put things back the way they used to be.'

- John Gribbon, Deep Simplicity



Planning For Chaos

Insight:

With a pandemic, you have no idea what your volumes will be. New York Presbyterian, a 1200 bed hospital, was 100% COVID ICU at one point. The current pandemic is particularly scary because we are living through a scientific development - COVID-19 is a six-month old virus that is still in its early infancy. This is exactly what happened with Smallpox and the Flu of 1918. There is no cookie-cutter response to pandemics like these. All we can do is to try to be socially responsible, continue to educate ourselves – bringing the best, newest information forward – and maintain flexibility in our response.

- Anthony Mistretta, former CNO, Healthcare Ops + Strategic Planning Executive, Perkins&Will

“In the midst of order, there is chaos but in the midst of chaos, there is order.”

- John Gribbon, Deep Simplicity

Chaos Planning

In the face of an Infectious Pandemic Surge, how do you plan for the chaos? The type of pandemic, its magnitude, and where and when it will occur are all unpredictable. Pandemics can draw down local and global resources in complex and unexpected ways.

Luckily, chaos isn't all just chaos and we can take some measures to be prepared for an infectious pandemic surge.

“Chaos is completely orderly and deterministic, with one step following from another in an unbroken chain of cause and effect that is completely predictable at every stage...It is just that it is impossible to predict in detail what is going to happen more quickly than events unfold in real time.” – John Gribbon, Deep Simplicity

“No strategist in a million years could have predicted that New York City would be crippled to the point of needing tents in Central Park because every ICU bed was filled with COVID patients.”

- Anthony Mistretta, former CNO, Healthcare Ops + Strategic Planning Executive, Perkins&Will

Case Study: Planning For Chaos

New York City, COVID-19

Rapid Expansion of Capacity:

“As the number of cases rose in the city, NYC Hospitals carried out plans to greatly expand critical care capacity. At baseline one NYC Hospital had an ICU capacity of around 300 beds. At the peak of the COVID-19 surge, the network was caring for 1,000 ICU patients. Another hospital in the Bronx increased from its baseline ICU capacity of 34 up to a capacity of 195.” – Health Affairs, Critical Care and ED Response at The Epicenter of the COVID-19 Pandemic

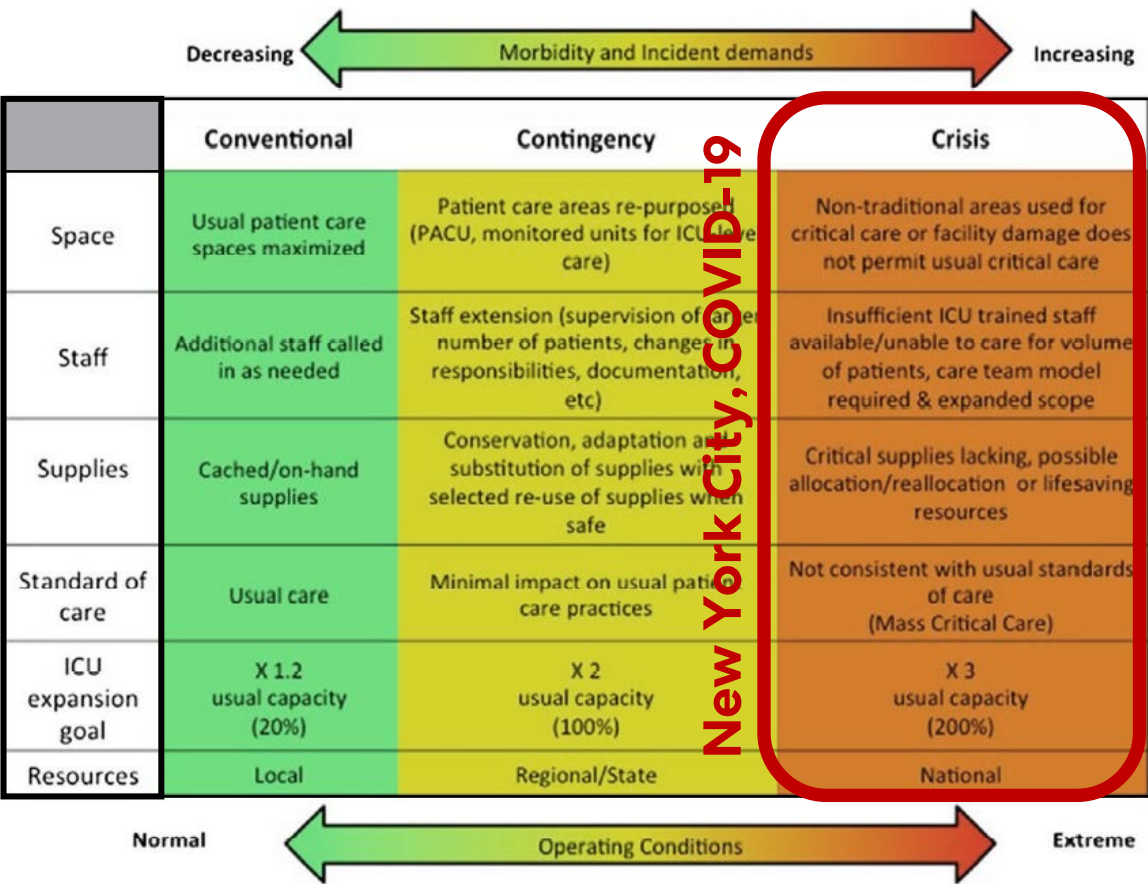
- Primary Intensive care unit (ICU) spaces were identified and upgraded as needed
- New ICU spaces were created in emergency departments and other inpatient units.
- Procedural areas such as endoscopy suites, perioperative suites, post-anesthesia care units, and operating rooms were identified as flex ICU spaces because elective procedures were being deferred.
- Patients were also transferred between hospitals to reduce strain.

Staff Recruitment:

“With so many staff members out and so many new patients, the array of doctors, nurses, pharmacists, and respiratory therapists who were accustomed to working in the ICU needed reinforcement - All people who are good with knives and big needles...” – Sheri Fink, Code Blue

Creative Logistics:

“Passenger aircrafts were put into freight service, production lines were converted over to produces needed medical products, and communities banded together to hand produce masks and other products. “ – Sean O’Neil, EVP, St. Onge Company



Pandemic Measure #1: Adapt The Way We Work

“...organisms at the edge of chaos tend to be highly adaptive.”

- Gustav Koehler, Guenther Kress, Randi Miller, *What Disaster Management Can learn from Chaos Theory*

- **Set Aside Traditional Top-Down and Linear Approaches:** to disaster management which are no match for the daunting challenges present in large-scale disaster situations.
- **Do Not Rely on a Hierarchical Management Structure:** which will restrict information flow and inhibit innovation.
- **Create Semi-Autonomous “Messy” Groups:** to solve problems in the field. This is a successful flat, decentralized disaster management structure.
- **Facilitate Effective Response Through Design:** support infrastructure processes that enable the response to rapidly organize itself. **Example:** providing a horizontal, deeply redundant communications system with sufficient capacity.

Pandemic Measure #2: Increase Capacity

“Strategy to increase capacity should make use of resources you have first – provide surge in-hospital before considering an ACF.”

- U.S. Department of Health & Human Services

▪ Follow Recommendations for ICU Capacity Increase During Pandemic Surge:

- **Immediate Conventional Response: 20%**
- **Contingency Response: 100%** (using local and regional sources)
- **Crisis Response: 200%** (using local, regional, national and international sources)

(As recommended by U.S. Department of Health & Human Services, WHO, Johns Hopkins Center for Health Security)

- **Provide a Core Number of Acuity Adaptable Units:** (where allowed by code) to allow for additional ICU capacity as needed.
- **Remember Staff Increases:** come along with patient increases and configure work areas to be expandable.
- **Create a Resilient Supply Chain:** by appropriately sizing supply areas and possibly introducing a Consolidated Service Center.
- **Design-in Flexibility:** for waste, sterilization, and decedent body handling surge requirements.

Pandemic Measure #3: Provide Infection Control

“If a hospital has not put in place adequate measures to prevent and control infection, it may amplify an epidemic by spreading the infection to patients, staff, and visitors.”

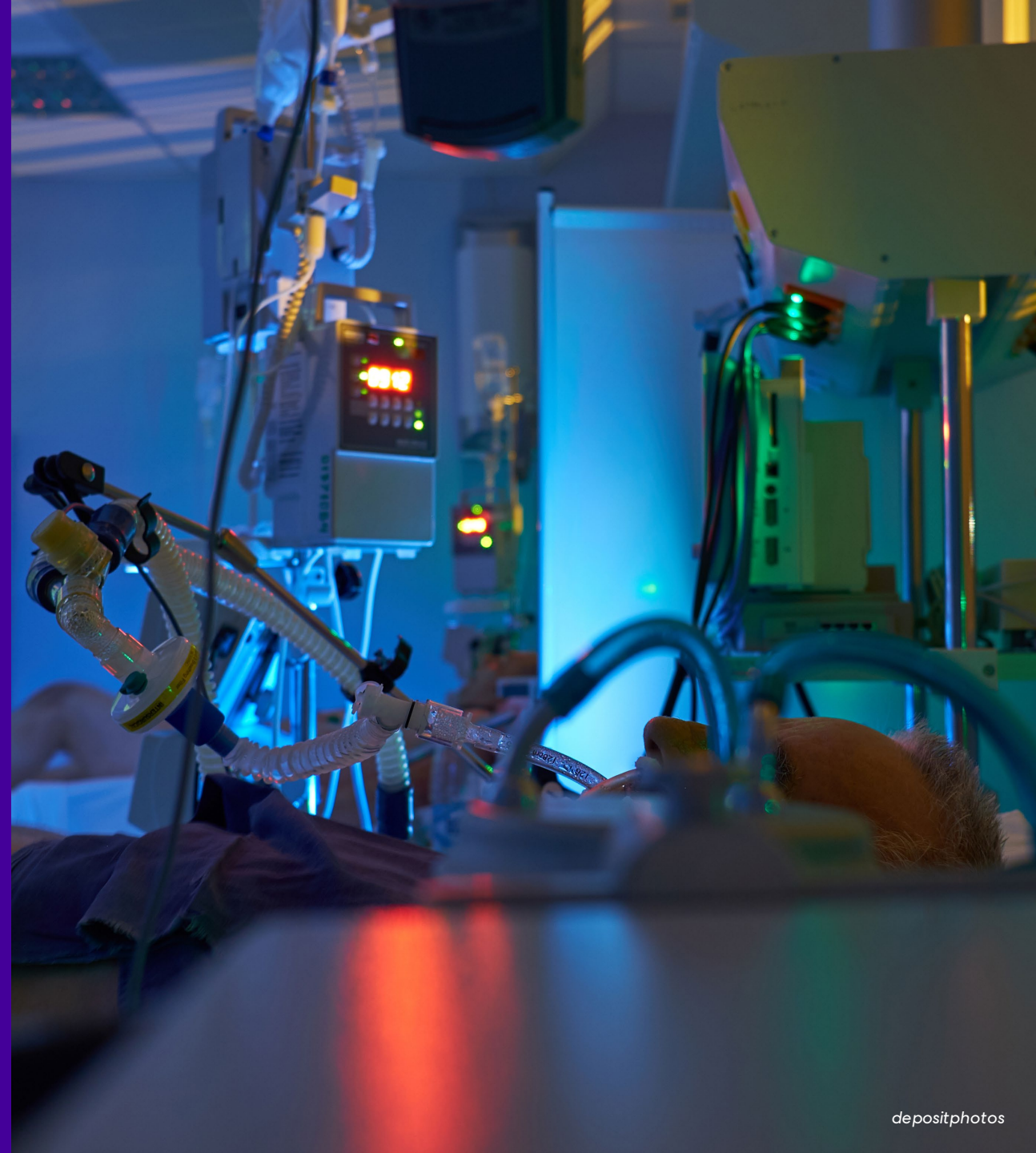
- WHO Hospital Preparedness for Epidemics

- **Leverage Technology Systems:** like Telehealth to keep patients and visitors out of the hospital when possible.
- **Re-Think Circulation and Waiting Configurations:** to distance and separate infectious and non-infectious patients in pandemic and non-pandemic conditions.
- **Cohort & Include Flex-Isolation Units:** that can operate normally and be easily converted during a pandemic.
- **Support Front-Line Worker Health/Safety:** by configuring spaces to limit exposure, allow availability of adequate personal protection equipment, and provide respite.
- **Ensure Continued Safe Use of Vital Hospital Services:** like the OR's, by designing-in the ability to accommodate infectious patients without compromising the care of non-infectious patients.
- **Incorporate Higher Standards of Ventilation and Filtration:** recommended by clinicians and Engineers based on their experiences with COVID-19.

Why The ICU?

'At the peak, our facilities had transformed into large ICU's.'

- New York City physician practicing during the COVID-19 surge



Why The ICU?

Testimonial:

The recent pandemic surge in New York City was the most devastating medical scenario I have experienced in 40 years. We were dealing with a virtual tsunami level of illness with incredible mortality associated with it. During the peak, there were 2700 COVID patients in the hospital, 800 of those were ventilated in the ICU. If you don't have enough ICU beds, you can't get through it. We've crossed the Rubicon on this. We can't go back to where we were.

– President and CEO of a major New York City hospital

The ICU is Crucial in A Pandemic

After the ED, it is the main line of defense in a pandemic response. Intensive Care Units provide care to patients with severe or life-threatening illnesses and injuries which require constant care, close supervision from life support equipment, and medication in order to ensure normal bodily functions. Studies show that 22% of all deaths in the US occur in the ICU.

“The Intensive Care Unit (ICU) is a specialized hospital unit dedicated to the care of patients requiring life-support and those at extremely high risk for organ failure and death. Death and dying is a daily occurrence in the ICU forcing the teams to function in a highly charged emotional environment characterized by persistent grieving and moral distress.

With regards to the physical environment of the ICU, near constant alarms, uneven lighting, poorly placed equipment, and space limitations can mean that the physical environment is at best not helpful and at worst harmful to the goals of team-based critical care.” - Teamwork in The Intensive Care Unit, Jennifer Ervin, Jeremy Kahn, Taya Cohen, Laurie Weingart

“Watching patients in the beginning was absolutely terrifying...”

- ICU Nurse who treated one of the first COVID cases in the US

Case Study: ICU vs. Alternate Care Site

"I don't know how they were able to set up decent air exchanges in the tents (during the COVID surge) and they don't have everything at their fingertips, obviously. There were probably a lot of runs back to hospitals. And nobody likes crickets in with their patients."
- Lynne Ingle, former OR Manager, Senior Director Medical Equipment Planning MERC/HLW

"Talking to clients, most want to be able to handle their surge within the hospital. It becomes very difficult to staff an ACS when you only have so much staff." - Marvin Williams, former ED Director, Senior Medical Planner, Associate Principal Perkins&Will

Converted Chicago Hospital:

The 4 week-long conversion of a shuttered Chicago Hospital to a Tier 2/2A/3, 585 bed, ICU Level, COVID Facility was a truly a heroic feat by the design, construction, and management teams involved. The conversion provides desperately needed surge capacity for the Chicago area going forward.

As an older facility built for a different function, the ACS faces some challenges not found in as ICU located in a more modern, operational hospital building.

- Patient visibility/patient separation is provided through doors with windows or through cubicle curtains (vs. ICU glass breakaway doors).
- The thru-window HVAC units brought in to create negative pressure block most of the light, so the rooms are dark.
- Food Service, Lab, and Pharmacy are all provided off-site.
- The loading dock is functional but there are some misc. storage issues - like the lack of properly rated rooms to house oxygen tanks.



ICU Unit

'A dark room with no alarms or phones.'

- Item #1 on Wish List of ICU nurse treating COVID-19 patients



ICU Unit

Testimonial:

“Saw my first COVID patient give up last night. He was struggling to breathe, maxed out on oxygen. It was time to drop a line and intubate and he said, ‘No, just let me go.’ Honestly, my heart hurts and any confidence I had last week is gone and I’m back to being scared shitless.”

– Tweet from Nurse treating COVID-19 patients

“I’ll never forget an overnight shift in the ICU in April. Got called in for a cardiac consult. 2 AM. Lights were off. 40 COVID patients in beds around an oval unit. Everyone sedated and intubated. Quiet as a graveyard. Scariest thing I’ve seen in 20 years of medicine.”

- Cardiologist treating COVID-19 patients

“Hospitals aren’t cookie cutters. What works for one may not work for another. A lot depends on their culture.”

- Marvina Williams, former ED Director, Senior Medical Planner, Associate Principal Perkins&Will

Unit Evolution

ICU beds, and by extension the ICU unit, were the most in-demand resource during the recent COVID-19 surge. The ICU Unit is the most fundamental module in long-term critical care treatment (vs. short-term care received in the ED). It is a complex set of spaces that serve to support life-saving care, the people who are saving lives, and those being saved. The extreme nature of day to day ICU practice has sorely tested ICU design over the years. The COVID-19 surge served to test it even further.

It is important that recommendations for the adaptation of the ICU Unit made to accommodate a future Infectious Pandemic Surge be responsive to the need. In addition, suggestions should enhance the best-practice unit design rather than replace elements that successfully support patient care and have taken years to develop. The following recommendations incorporate studies of the evolution of ICU Unit design as well as crucial feedback from front-line clinicians during the first wave of COVID-19.

“When I was admitted, I was told that, if they put me on a ventilator, I had a 50/50 chance of survival. As not going on a ventilator was a zero chance of survival, I said yes.”

- COVID-19 patient

Case Study: ICU Unit

Space Allocation in Award Winning ICU's of The Last Two Decades

Study Scope:

The study includes a set of 25 adult ICUs that were awarded between 1993 and 2012 by the Society of Critical Care Medicine (SCCM), the American Association of Critical Care Nurses (AACCN), and the American Institute of Architects/Academy of Architecture for Health (AIA/AAH) for their efforts to promote the healing of critically ill and injured patients through the design of the critical care unit environment.

Type :

The racetrack layout has been the most dominant unit type among award winning ICU's during the last two decades...it provides more space and perimeter wall for more patient rooms with natural light and outside views, it accommodates more compact and centralized support and helps reduce the physical distance from patient rooms to support areas. Some studies show that radial units perform better than single and/or double corridor units due to better visibility and shorter walking (Shepley & Davies 2003).

Size:

"The size of an ICU must be appropriate for constant visibility of ICU patients by providers. It must also be appropriate for care providers to be fully aware of all the people, not just the patients and activities on the floor. Additionally, the size must also be appropriate for less walking and noise." – Rashid Mahbub, *Space Allocation in Award Winning ICU's of The Last Two Decades*.

The SCCM Guidelines recommend maximum 8-12 beds per unit for better observation. In general, larger ICU's with more beds have more acquired infections. The study shows the average number of beds for all the units was 24, which is a much higher number than the numbers recommended by SCCM.

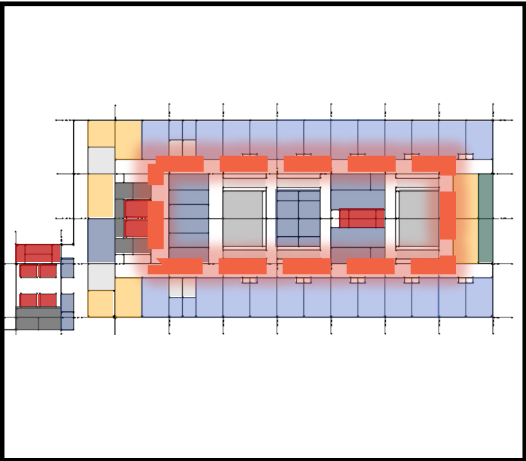
Type	Simple forms	Complex forms	
Open or Nightingale			
Corridor or continental			
Duplex or Nuffield			
Racetrack or double corridor			
Courtyard			
Cruciform or cluster			
Radial			
<div> <div></div> Patient space <div>★ Nurses' base</div> <div></div> Staff space </div>			

ICU Unit

“The number of beds is client dependent so solutions starting with a 12-bed unit that could be replicated to 24 and 48 would be appropriate. What I would want as a client is something that is flexible enough for me to be able to expand it if I wanted to expand it and had the budget to do it.

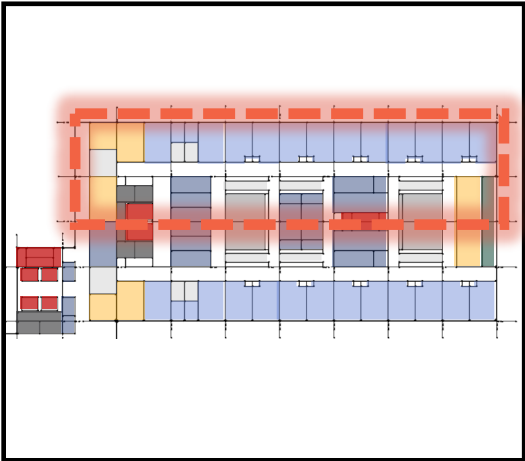
- Anthony Mistretta, former CNO, Healthcare Ops + Strategic Planning Executive, Perkins&Will

Proposed Configuration:



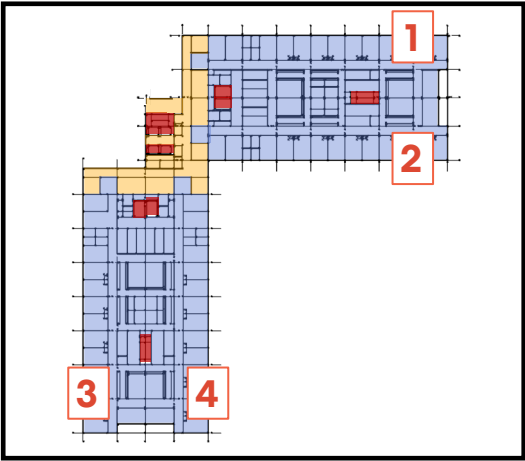
Racetrack

ICU Study – most effective



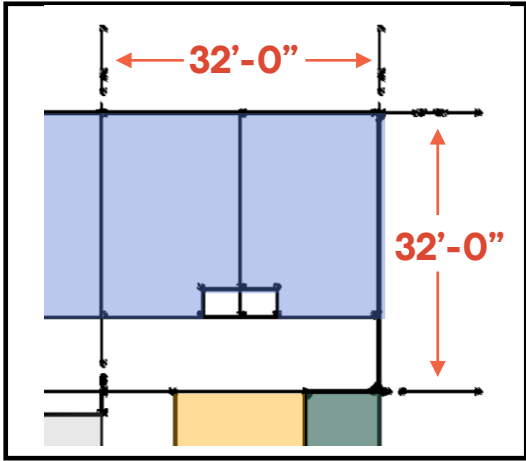
(2) 12-Bed Units = 24

ICU Study – optimal size
Up-scales to 48 beds



**Overall Floor Plate -
L-Shape (4) Units**

Efficient – fits in smaller site footprints
Discreet wings support cohorting



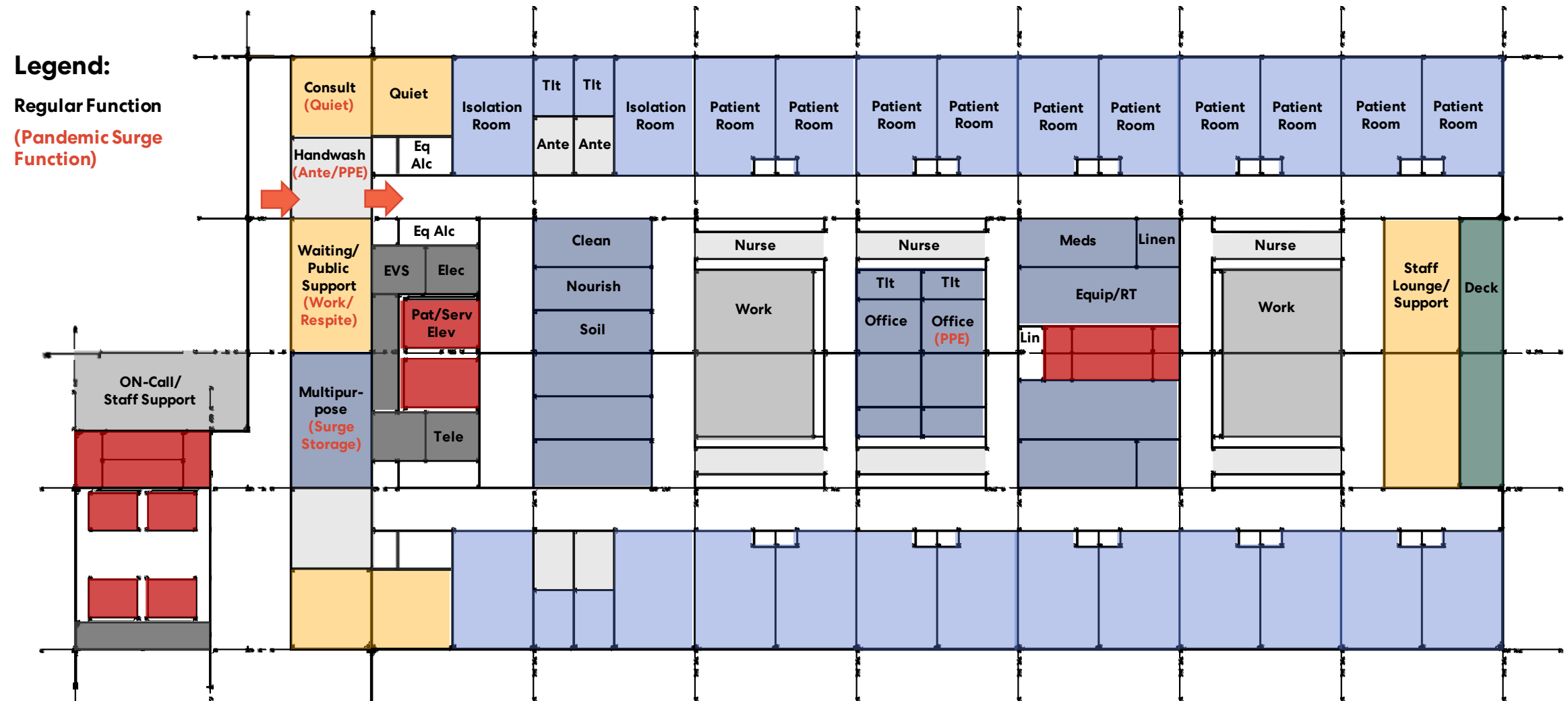
Rooms on a 32'-0" Grid

Accommodates FGI and OSHPD
clearances

ICU Unit Diagram

“Even though critical care practice has already undergone significant changes in the last few decades, it is still an evolving domain of medical practice. As a result, ICU design is also evolving...”

– Rashid Mahbub, *Space Allocation in Award Winning ICU's of The Last Two Decades.*



Unit – Contributor Wish List

(#2 Increase Capacity) **Add More Isolation Units**

“We pushed out the patient room windows and brought in (HVAC) machines. They were SO LOUD.”

– Nurse treating COVID-19 patients

(#1 Adapt the Way We Work) **Provide Respite Room**

“Outdoor space. A nice garden where we can go out and eat lunch.”

– Department Director, major New York City Hospital

“A nap room with La-Z-Boys.”

– Nurse treating COVID-19 Patients

(#3 Provide Infection Control) **Give Us PPE Cabinets**

“I didn’t become infected with COVID because I wore PPE.”

– Westchester Pulmonologist who treated hundreds of COVID-19 patients in the ICU

“We have wall-mounted PPE cabinets in the hallways with card access. People steal PPE, mainly the visitors.”

– Nurse treating COVID-19 patients

“I don’t like the idea of using one set of PPE for all patient rooms, even if the unit is an isolation unit. I feel like we would be protecting ourselves and not the patients.”

– Nurse treating COVID-19 patients

Case Study: Isolation Unit

"What's being discussed in the post-COVID design world right now: How do you flex a unit to become completely negative? How do you do it when you have an existing building and an existing mechanical system?" – Anthony Mistretta, former CNO, Healthcare Ops + Strategic Planning Executive, Perkins&Will

The Case for Isolation Units:

- **Respiratory Transmission:** The 2017 Johns Hopkins Bloomberg School of Public Health Center for Health Security paper, *The Characteristics of Pandemic Pathogens*, states that the respiratory route is the mechanism of transmission most likely to lead to pandemic spread. This is because interventions to interrupt this method of spread are more difficult to implement. Isolation Units are one such method.
- **Cohorting:** Placing patients infected with the same pathogen in the same unit is recommended by the CDC, WHO, Johns Hopkins Bloomberg School of Public Health.
- **PPE:** some (not all) clinicians and health organizations feel Isolation Units can reduce the need for donning and doffing each time a caregiver enters a patient room. (Note: some feel that patient safety mandates continuing this practice even in Isolation.)

Successful Isolation Unit Retrofit Test Model:

(2015 findings published in the American Journal of Infection Control, 2017)

- **Functioning Hospital:** A functioning hospital in the San Francisco Bay Area was used.
- **Chosen Ward:** the chosen ward was located on a top floor where it could be effectively isolated. It had an existing dedicated air handling unit, a dedicated bathroom exhaust system, and a firewall separating it from the rest of the hospital.
- **Modifications:** the AHU was set to 100% outside air and 100% exhaust. HEPA-filtered negative-air machines were operated in the ante room created at the entry. The fire doors were closed to seal the unit off.

Successful Temporary Isolation Unit Test Model

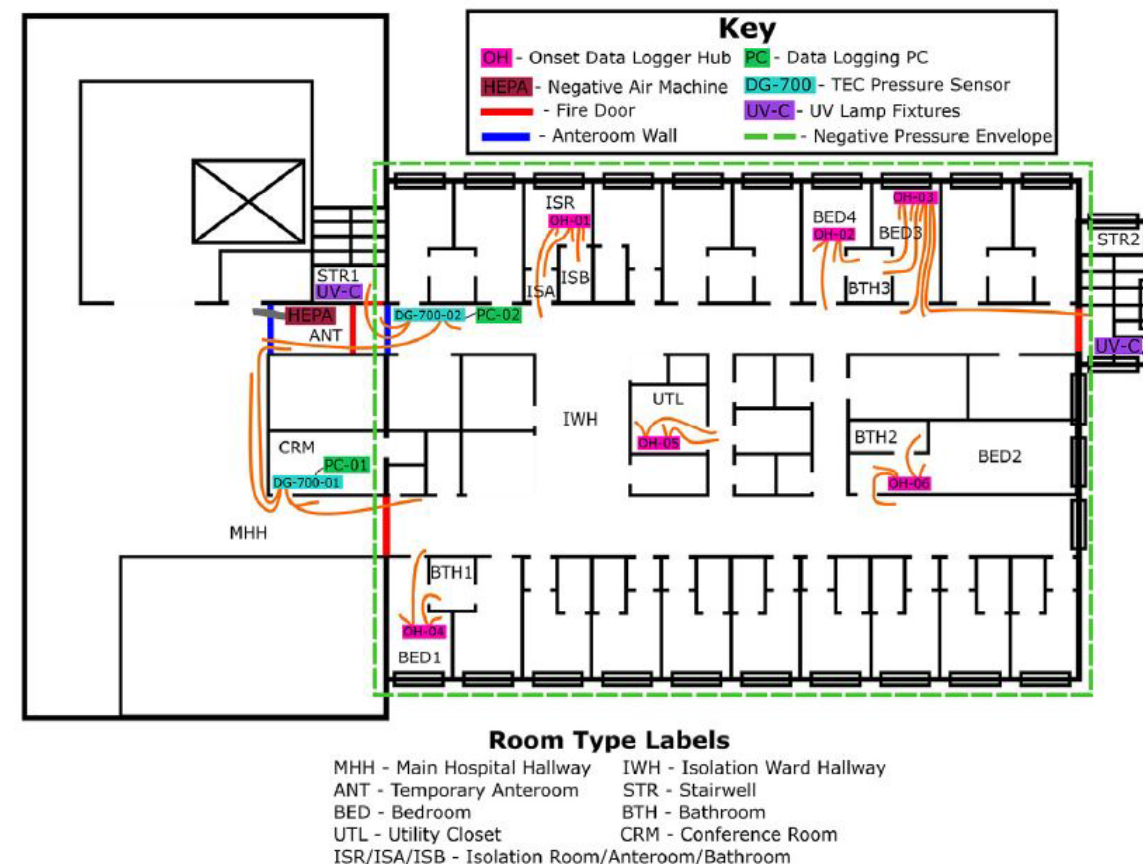


Fig 1. Isolation ward layout and instrument locations. PC, personal computer; TEC, the energy conservatory; UV, ultraviolet.

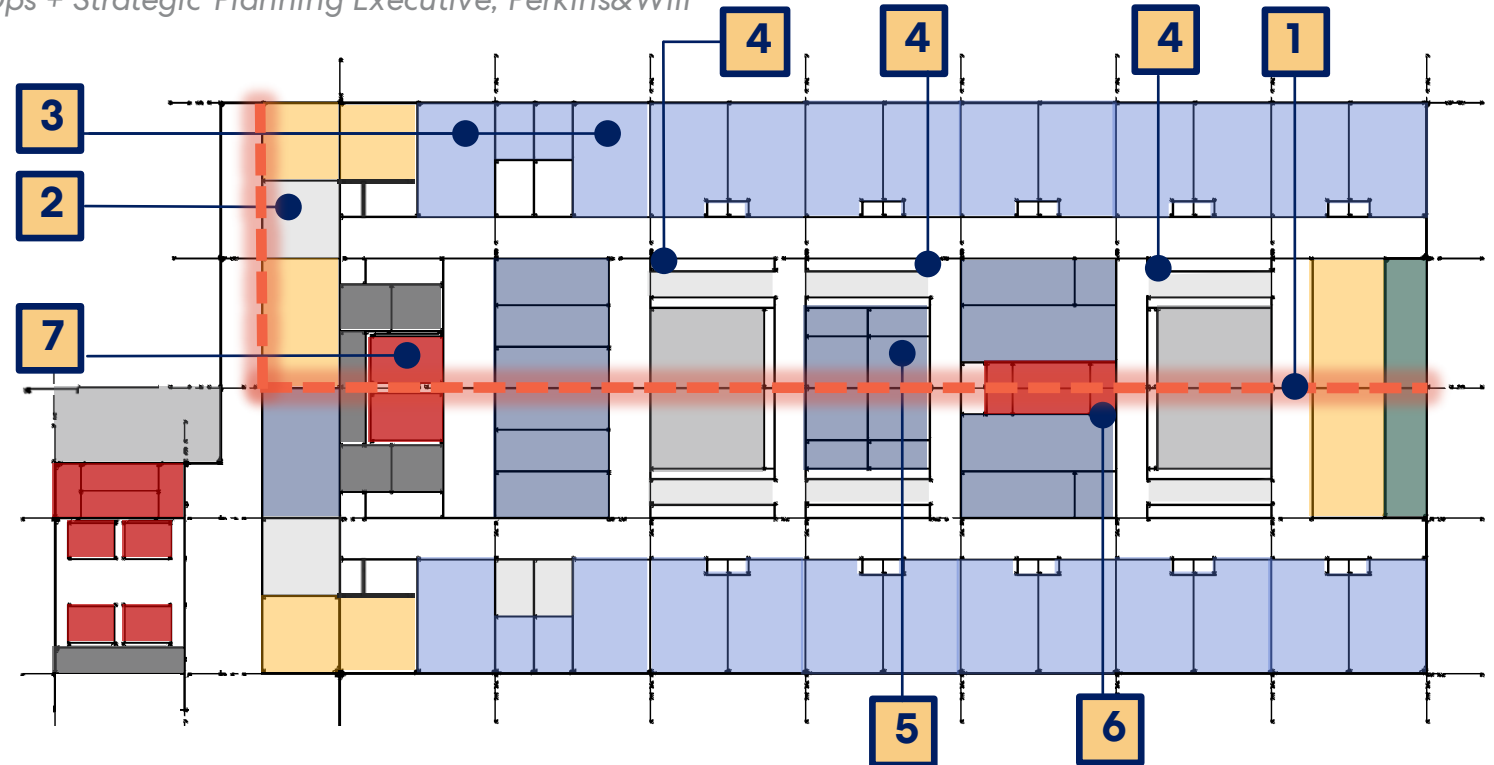
(#2 Increase Capacity) Add More Isolation Units

ICU Unit – Isolation Unit

“If the unit is going to truly be an HVAC controlled isolation unit, you can have significant space savings without all those ante rooms outside of every single room. When the isolation rooms are scattered throughout the unit, we aren’t doing anything from an overall infection control perspective and we are creating barriers to normal patient care in those rooms - the doors all alarm so you can’t just take the ante rooms away when you’re not using them.”

- Anthony Mistretta, former CNO, Healthcare Ops + Strategic Planning Executive, Perkins&Will

- 1** Smoke Barrier Provides Unit Isolation
- 2** Ante Room at Entry – Handwashing & PPE
- 3** Optional Added Isolation Rooms
- 4** Additional Handwashing Sinks at Nurses Stations
- 5** Additional Gowning Room (Flex)
- 6** Dual-Entries to Exit Stair To Avoid Exiting Through Second Unit or Shared Corridor
- 7** Dedicated Unit Elevator



Case Study: ICU Units Adapt New York City, COVID-19

Creative Staffing Solves Personnel Shortages:

“Manual proning, an intervention that puts a patient in a prone position to improve gas exchange, used in patient with COVID-19 induced respiratory failure, was performed under the direction of surgical teams with experience performing the maneuver in the operating room. Critical Care nurse and physicians formed these proning teams. Anesthesia physicians and providers staffed procedural teams to perform endotracheal intubations and obtain vascular access. This liberated ICU physicians from those tasks and thus expanded their capacity for patient care. Tiered staffing structures used ICU doctors and nurses to lead teams of non-ICU providers to manage the volume of patients. This approach significantly expanded capacity to deliver high-quality critical care.” - Critical Care and ED Response at The Epicenter of the COVID-19 Pandemic

“Critical Care staffing was supplemented by temporary recruits, volunteers and Department of Defense medical personnel.” - Critical Care and ED Response at The Epicenter of the COVID-19 Pandemic

Increased Demand On Support Spaces:

“One of the biggest lessons learned (curing the COVID-19 pandemic) is that the EVS closets and the Soiled Utility Rooms need to be bigger than the current code requires them to be. They were completely inadequate in the hospitals of almost every single client I have spoken to. When you are donning and doffing for 24 beds every single time every single person goes in there, the waste that is coming out is astronomical. I don't think people realize how fast the waste piles up. Increasing pick-ups in these rooms would also work but only if there is the staff to do it – which there wasn't.” - Anthony Mistretta, former CNO, Healthcare Ops + Strategic Planning Executive, Perkins&Will

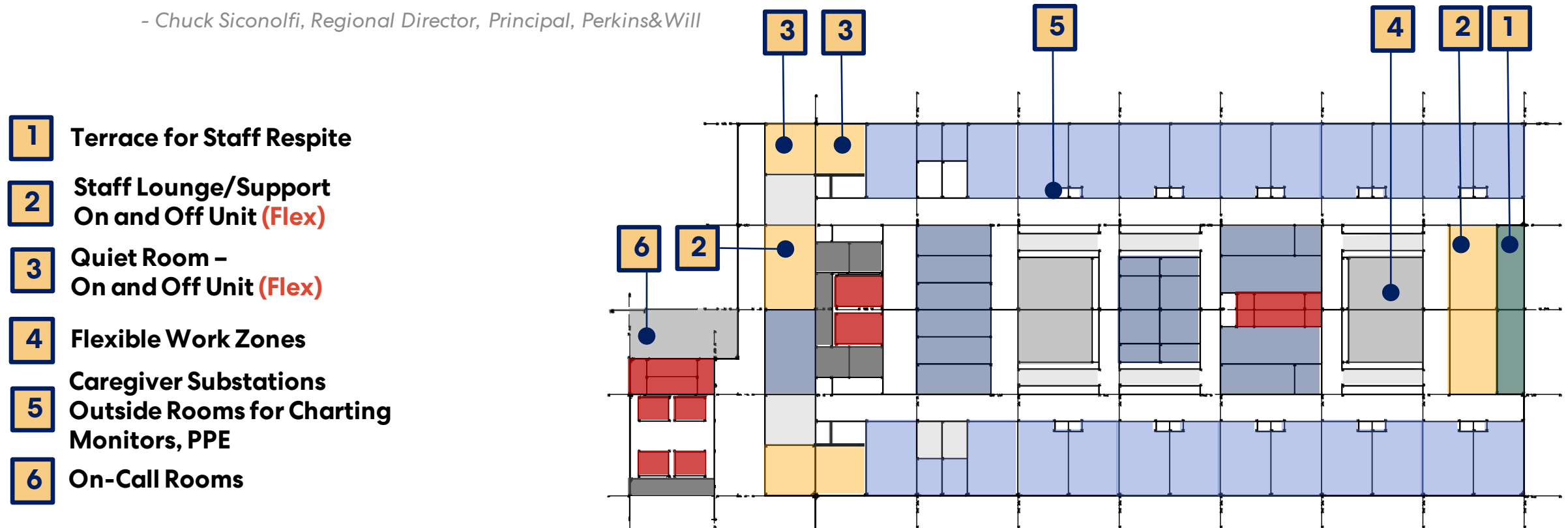


(#1 Adapt the Way We Work) Provide Respite Room

ICU Unit – Staff

“If you ask a clinician what their wish list is, they will say shorter hours and less stress. These aren’t things we can address with design solutions, but we can enhance the human experience by providing respite outside units with views to light and air.”

– Chuck Siconolfi, Regional Director, Principal, Perkins&Will



(#3 Provide Infection Control) Give Us PPE Cabinets

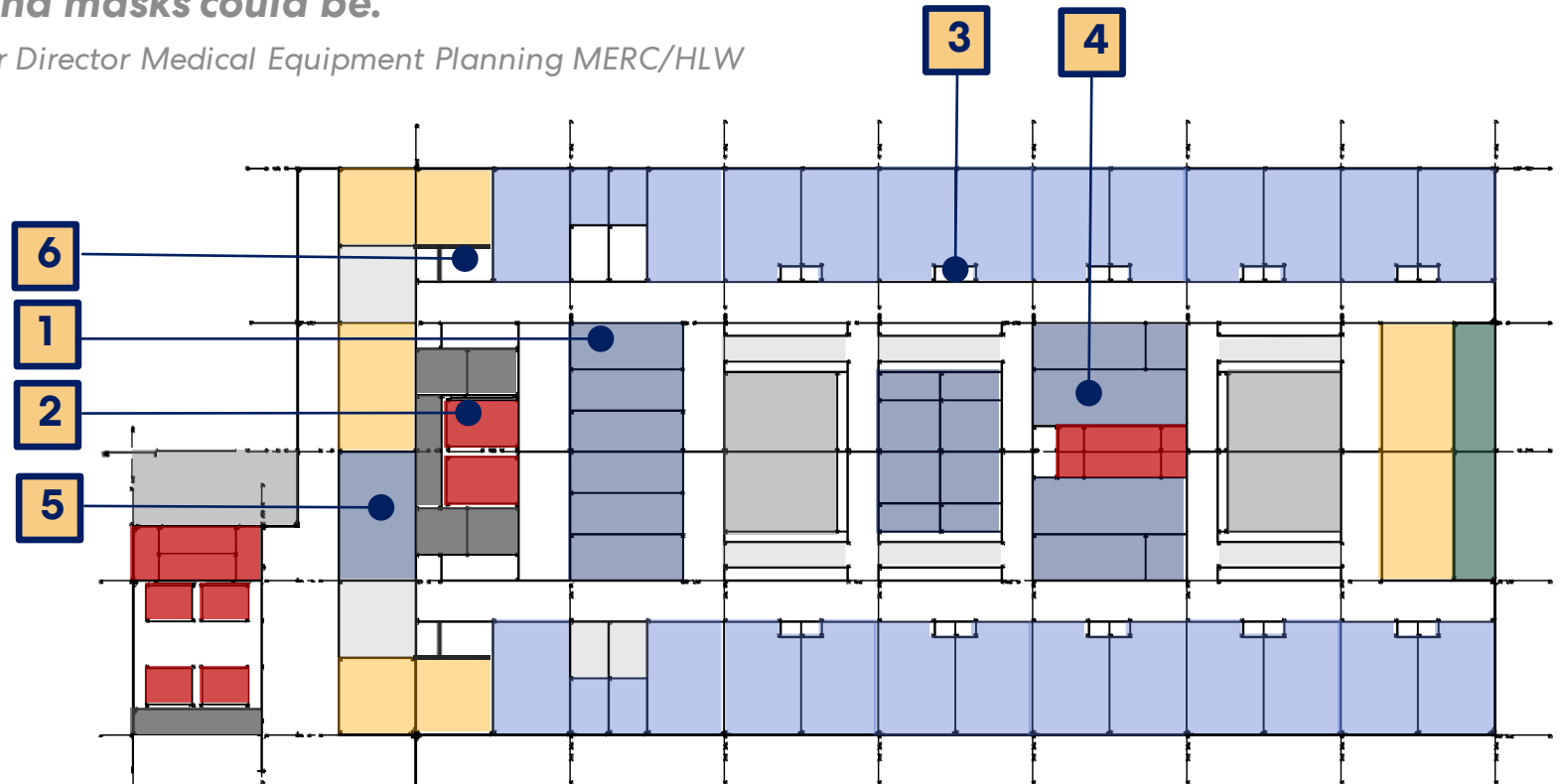
Required PPE:	Mask	Gloves	Face Shield	Gown	Apron	H2O-Proof Boots
Airborne	X	X	X	X		
Ebola	fluid-resistant	double	X	impervious	H2O-proof	X

ICU Unit – Support

“Because getting PPE’s was such a problem and they were making people wear the same thing over and over again, having the ante room at the beginning of the unit was possibly the only viable idea. You should be changing each time you go into a different room. You would need several areas for changing which might be like scrub-sink setups where handwashing sinks and all your gowns and masks could be.”

- Lynne Ingle, former OR Manager, Senior Director Medical Equipment Planning MERC/HLW

- 1** Disneyland Concept: Back-fed Support Rooms
- 2** Dedicated Unit Elevator
- 3** Distributed PPE Cabinets
- 4** Larger Support Rooms
- 5** Pandemic Surge Back-Up Storage Off The Unit **(Flex)**
- 6** Large Imaging Alcove



Technology Solutions

“Technology needs to respond to a particular need. It needs to support people. It can’t be technology first.”

- Phil Crompton, Vantage Technology Group



Alarm Fatigue

“The biggest problem in the ICU is that everything is alarmed. After about a week, the staff put their phones in their pockets because they can’t handle it anymore. There are so many alarms in a hospital, no human brain can process them all. The next generation of alarm systems filter to reduce alarm overload.”



Monitoring

“An ICU has an awful lot of monitoring now. I don’t think there is a box of pandemic equipment that you would deploy. A lot of the new technology helps just as well if we’re not in a pandemic situation.”



Telehealth

“Lots more video telehealth within the room. Next generation of telehealth: testing, imaging, monitoring. What’s next? At-home do it yourself ultrasound.”

- Phil Crompton, Vantage Technology Group (multiple quotes this page)



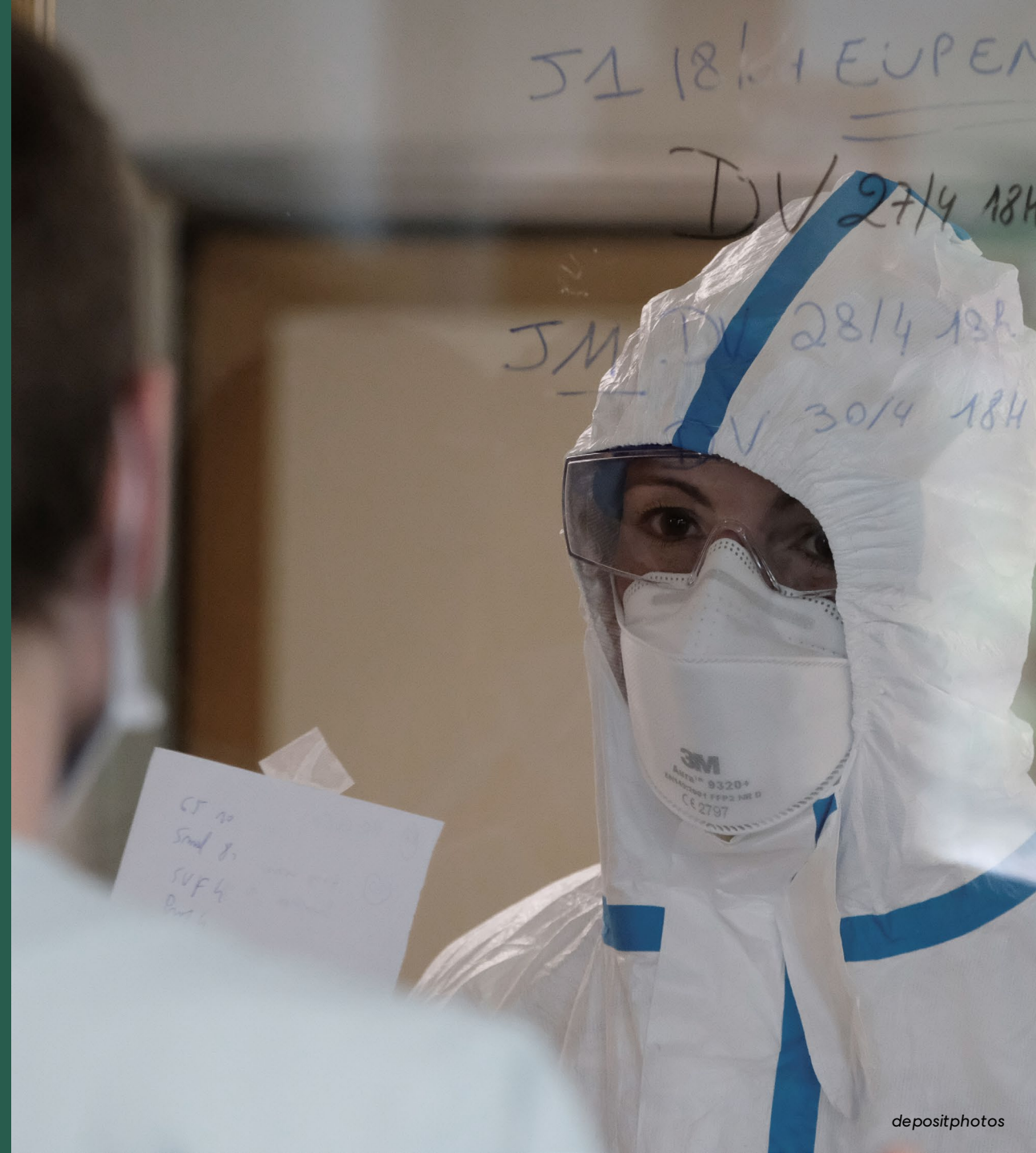
Tracking (RTLS)

“There’s a badging system called ‘Friend or Foe.’ If you want to make sure your staff doesn’t go within 6 feet of an infectious patient without knowing it, you can badge them up. If they go closer, the badge will beep at them. This is actually being used by the NFL to ensure the players maintain social distancing during training camp.

Room

‘Every time the pulse-ox went off we had to gown up to go into the room. It was a time-consuming hassle.’

- ICU Nurse treating COVID-19 patients during the surge



ICU Room

Testimonial:

“It’s the COVID-19 Pandemic, early days, when my cousin sends me the txt. There’s a video - something about UK physicians and a thing called ‘proning.’ My cousin is a graphic artist who worked some years at the San Francisco Zoo so her txt’s are usually good for something absurd and animal related. I have nothing to do except lie in bed and try to move the cement block now occupying the lower third of my lungs up and down so I can take a breath. I click, ready to laugh. But it’s not funny.

Instead, it’s rather miraculous. In the midst of this global whirlwind of people being rushed to the ER gasping for breath - only to be intubated, put on respirators, and die, these doctors have simply rolled people over on their sides and may have saved their lives. Now, my cousin is no stranger to respiratory distress herself, having almost died as her Lupus-compromised immune system caused her body to attack her lungs 10 years ago. So, I take this suggestion seriously. I try it immediately and I roll over onto my side. I can breathe.”

- Author, COVID-19 patient

“Proning – it didn’t make me laugh but it might have saved my life.”

- Author, COVID-19 patient

Room to Work

Providing enough space for caregivers to work in the ICU room is key during normal operations. During a Pandemic it is crucial. Patients will be sicker and in crisis. They will need more care from more people - fast. How much space is enough changes as care changes.

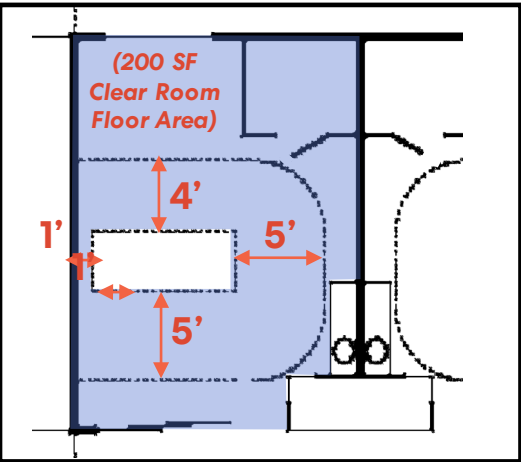
One recent, useful study made by the Department of Human Sciences at Loughborough University (UK) describes a series of functional experiments undertaken to test the spatial requirements for various nursing functions performed in the room. The analysis found that an average of 250 SF (23.26 SM) was needed to perform a bed to bed transfer and 246 SF (22.87 SM) was needed for resuscitation.

ICU Room

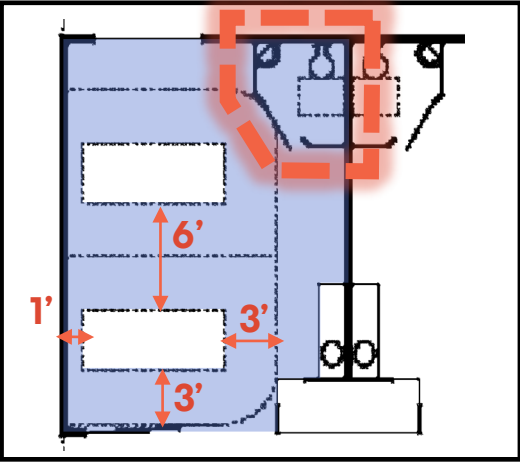
“I think it’s a reality that you may have half a dozen people in those rooms at a time. Nurses, doctors, RT’s, someone doing dialysis. I’m sure that all the furniture got moved out of there, so they had more room You don’t really want to make the room larger because you have wasted space when there isn’t a pandemic. A hospital could never afford that kind of thing.”

- Lynne Ingle, former OR Manager, Senior Director Medical Equipment Planning MERC/HLW

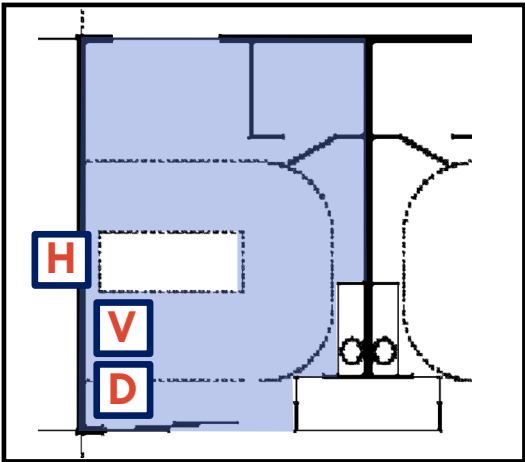
Proposed Configuration:



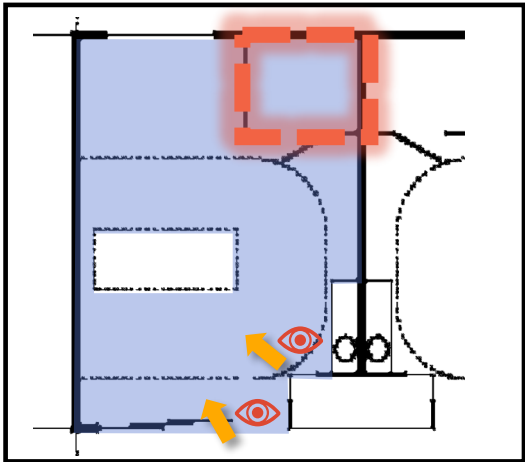
Bed Clearances
FGI
OSHDP



(2) Beds in 1 Room
6'-0" Between Beds – CDC
Toilet room must be configured to accommodate 1 and 2 bed clearances



Architecturally Significant Equipment
Headwall
Ventilator
Dialysis



Enclosed Outboard Toilet
Prevents in-room aerosolization of bedpan washer
Allows maximum visualization of patient from corridor

ICU Room

“There are also a lot of hospitals that use booms in ICU, especially the newer ones. In trauma, they equip them so they can service 2 patients. The same could be done in ICU.”

- Lynne Ingle, former OR Manager, Senior Director Medical Equipment Planning MERC/HLW

Proposed Configuration - 2 Patients in 1 Room:

Gas	FGI	OSHDP
Oxygen	3	3
Vacuum	3	3
Medical Air	1	1



ICU - Required Gasses
Per Bed
FGI
OSHDP

Headwall

“Each patient needs O2, air, and suction. If you built the ICU headwall to meet usual (California) state requirements, you might be OK. Running lines to the second patient is the issue right now (the length).” – Lynne Ingle

Boom

“Often the booms are located on both sides of the patient. One side is the dry side. The other is the wet side. The wet side would have your ventilator on it.”
- Lynne Ingle

Covered Outlets

“A less expensive choice is to design the headwall for 1 patient and add thru-wall gas outlets only for the second patient, which are covered when not in use.” – Lynne Ingle

ICU Room – Contributor Wish List

(#2 Provide Infection Control) Take Monitors Out Of Rooms

“Keeping monitors outside the rooms saves a lot of re-gowning time. Placing wireless vital signs monitors in alcoves right outside the room really helps.”

– Nurse treating COVID-19 Patients

(#1 Adapt the Way We Work) Add Windows

“Visualization of patients is key. We installed windows in our Med Surg unit doors when we used them for COVID patients.”

“Through the window you can see a patient is having trouble breathing because they become lethargic and start using their chest muscles to breathe. You can see the O2 going down (on the pulse-oximeter). We can tell the patients to prone themselves using hand motions – we would flip our hands.”

– Nurse treating COVID-19 Patients

(#3 Increase Capacity) Add More Isolation Rooms

“She had to intubate patients in double rooms. She couldn’t move them – there wasn’t time. Also, they were hooked up to IV’s, monitors, gasses...”

– Chuck Siconolfi, Regional Director, Principal Perkins&Will re: Nurse Anesthetist intubating patients in the ICU

Case Study: ICU Room Challenges

New York City, COVID-19

Alcoves Between Rooms:

"Staff members had separated control boards from some of the ventilators, so they could adjust their settings and monitor patients without going inside their rooms unless necessary, reducing exposure to the virus. Nurses were making a similar adjustment with the pumps that delivered intravenous medications, adding extension tubing that snaked across floors to hallways. Workers rushed in and out of the rooms (to repeated warnings) "Watch out!, Don't trip!" – Sheri Fink, Code Blue

"I don't know how bad it was but, oh, man, they were using a lot of Infusion Pumps. Each pump has the ability to deliver 4 meds. Some hospitals developed tubing extensions so the pumps could be set outside the sliding doors and nurses could stay out of the rooms (because getting PPE's was a problem)." -

"It may become more critical to have an area outside the room to chart and monitor – not necessarily just have the physio-monitor in the room but also 1 outside it." – Lynne Ingle

Equipment:

"Often dialysis is an outside contract so they have portable dialysis machines that can come into the rooms. It's important to make sure the mobile dialysis unit has self-contained water because you have to have special water for dialysis. Sometimes there are places in the hospital where they can be refilled." – Lynne Ingle

"Ideally you want to plan for at least 1 ventilator for each room, but no budget is going to be able to afford that. We're going to see a lot of different kinds of ventilators show up that aren't necessarily on the market at this very moment."

"They were sharing the types of ventilators we have now. The only issue there is that each patient had to be on the same ventilator settings." – Lynne Ingle

"Portable x-rays – bring x-rays to the bedside." – Lynne Ingle

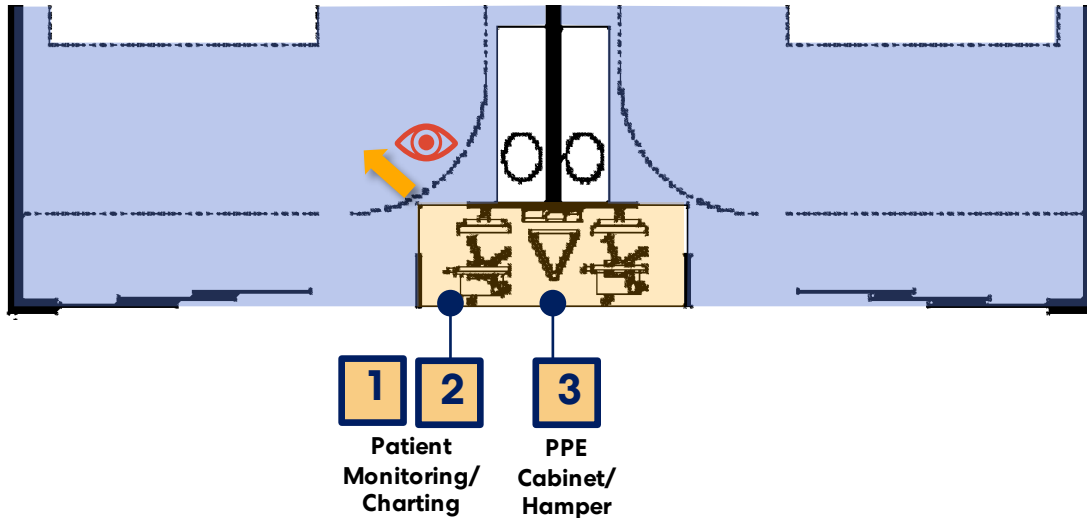


(#2 Provide Infection Control)
Take Monitors Out Of Rooms

(#1 Adapt the Way We Work)
Add Windows

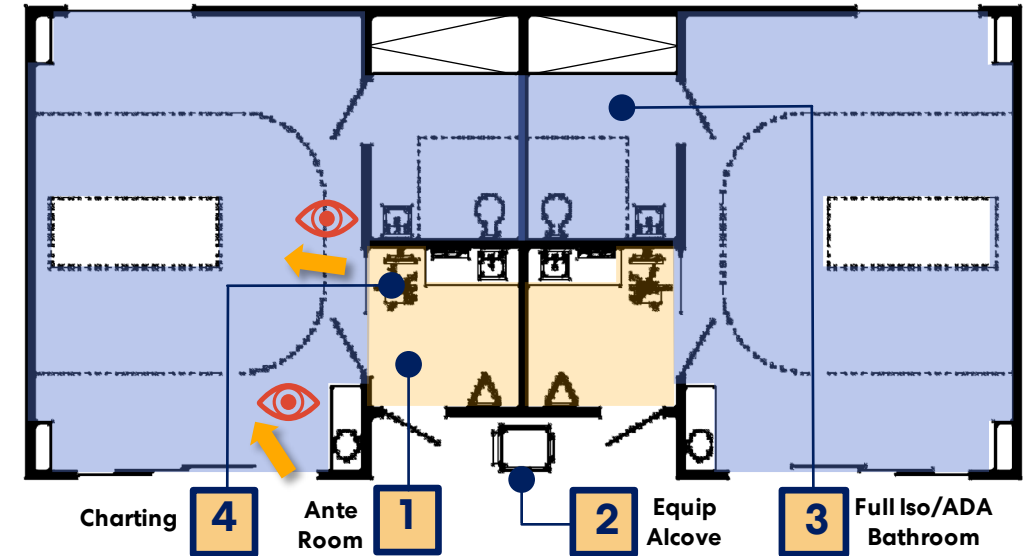
(#3 Increase Capacity)
Add More Isolation Rooms

ICU Room - Adaptations



Caregiver Substations

"If there was a way to allow nurses to adjust alarms and settings without having to enter the room – if every time the patient bends their arm and the IV pole goes off because of a kink, they don't have to go into the room and waste an entire set of PPE just to lay the person's arm straight." – Anthony Mistretta, former CNO, Healthcare Ops + Strategic Planning Executive, Perkins&Will



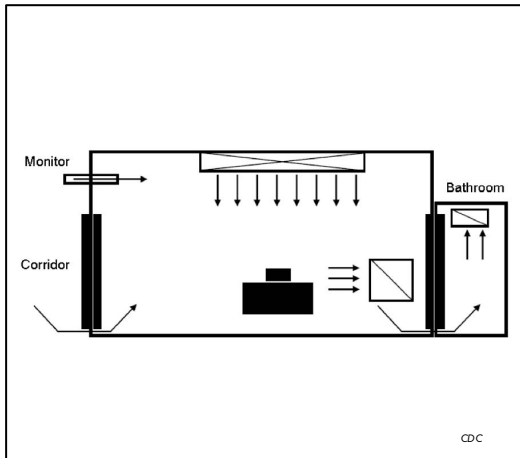
Optional Added Isolation Room(s)

"Ebola is a deadly disease. At one hospital we put two negative pressure rooms together (right off the triage area) with a door in-between them. With Ebola, the patient is highly contagious. You have to wear a special suit and bring down the bubble over the patient. If someone walked in and was experiencing what we thought was Ebola, we put the patient in one room and called the Ebola Team. They came down and donned in the other room and went through the door between the two rooms." – Marvin Williams, former ED Director, Senior Medical Planner, Associate Principal Perkins&Will

HVAC Solutions – All Rooms

“If you have a patient that’s in ICU with an endotracheal tube in while they’re on a ventilator and it’s there longer than two weeks, you really need to do a trach on that patient. As the ventilator works, the tube runs up and down the airway and that tends to irritate the airway and also cause scar tissue. I would think in a pandemic they would be done right in the room and be a source of aerosolization.”

- Lynne Ingle, former OR Manager, Senior Director Medical Equipment Planning MERC/HLW



Air

- Negative Air Pressure - 2.5PA
- Air Changes Per Hour (ACH) – 12
- Alarmed Air Pressure Monitor
- If An Ante Room is provided, air should flow from the corridor to the Ante Room and from the Ante Room to the All Room



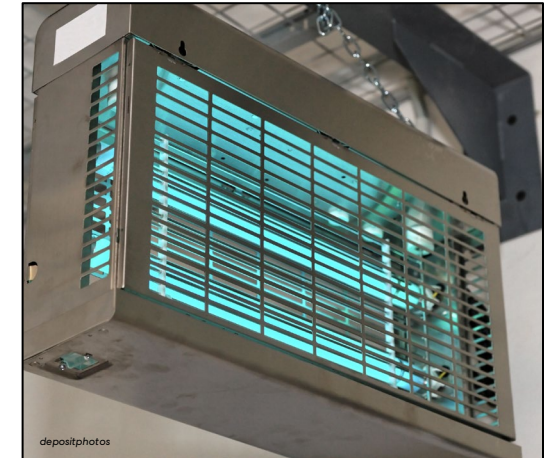
Exhaust

- Exhaust must be discharged directly to the outside without mixing
- Exhaust Fan located outside away from intakes and public areas



Filtration

- Minimum-Efficiency Reporting Value (MERV) 7 pre-filters
- MERV 14 or High-Efficiency Particulate Air (HEPA) final filters



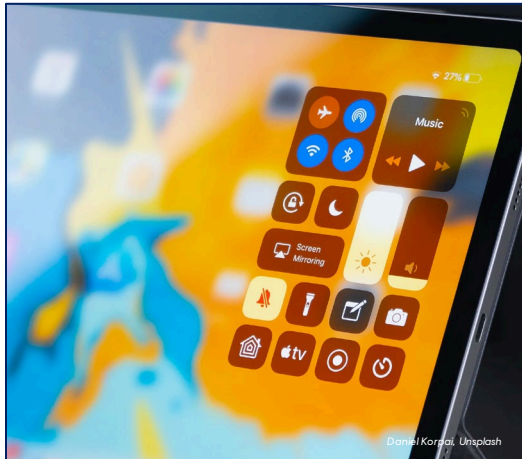
UV

- Coil Sterilization or Air Sterilization
- Must be mounted next to the evaporator and on the downstream (cold air side) of the coil
- The UV rays must shine on the cooling coil and the water drain pan
- Designed to work in tandem with a particle filter

Technology Solutions

“It is the patient’s right to receive visits, therefore the risk of ARI (Airborne Respiratory Infection) transmission should be mitigated. “

- WHO Guidelines, Infection Prevention and Control of Epidemic and Pandemic Prone Respiratory Infections In Health Care



Patient Dashboard

“A major Southern California Hospital put the Microsoft Surface Hub in every ICU. It’s like a big iPad you hang on the wall. They facilitate remote consults and family visits through that. People passing away alone - to me that’s a massive failure of the system when we let that happen.”



Remote Monitoring

“The next generation of cameras can not only give you an image of someone, they can tell you what their temperature is. This all means that staff can watch over their patients without having to physically go into the room itself.”



Charting

“If you have to do bedside charting, you don’t want the computer fixed to a wall by the bed in the ICU. Hospitals are looking at replacing those fixed units on walls with laptops or tablets. The problem there is that the majority of electronic medical records systems aren’t really supported on a tablet.”



UV Technology

“You can build it into the lights but there are also robots that can move around the room – a Roomba with a big UV light on it.”

– Phil Crompton, Vantage technology Group (multiple quotes this page)

Hospital

'We had a lot of meetings. There was a lot of meeting going on.'

- Department Director, major NYC hospital



Hospital

Testimonial:

The flow of patient traffic is very, very important. There's not much you can do about being in Manhattan and not having a lot of space to work with. If you have good patient flow in a small space, it really makes a lot of difference.

We now have patients enter through different entrances so that we don't have overcrowding at our main entrance. It seems like a good solution but then you have to take into consideration the fact that you need more screeners at more entrances and with more screeners you need more PPE. With more screeners it means those people volunteering are stepping out of their roles, whatever their roles were before, and we're not in a position to try and fill roles. With more screeners it also means you need more people volunteering to be frontline - interacting with thousands of people every day.

- Department Director, major NYC hospital

"With each decision that is made, there are a lot of caveats that come with it."

- Department Director, major NYC hospital

Keeping The Hospital Healthy

Flow: although the ICU Unit is the focus of this study, the ICU Unit is not an island. Understanding it means understanding how it fits into the larger Hospital. Infectious Pandemic Surge Planning must take into account how staff, infectious patients, and supplies get in and get out. The safety of the patients and the staff in the Unit, as well as the safety of everyone they come into contact with inside the hospital, is dependent on creating flows that minimize the spread of disease from the minute they enter through the front door of the hospital building.

Operations: keeping the hospital healthy means keeping the hospital open. It's vital that we try and help these life-saving institutions stay as fully operational as possible during a Pandemic. Surgery is the life-blood of the institution and clinicians and planners are studying how to keep this department fully functional in an infectious environment.

Case Study: Preventing The Spread New York City, COVID-19

Minimize Patients In The Hospital:

"Solutions to reduce the number of patients at one time in the hospital and allow for social distancing include: Preregistration, Just in time: Patients must be seen at the times of their appointments - no waiting, Telemedicine/E-ICU to help other facilities/locations." - recommendations from a major New York Hospital

Social Distancing:

"Being in Manhattan, one of the biggest challenges is that nobody is prepared for social distancing. In the height of the pandemic, when everything was so scary and so uncertain, it was almost easier than it is now. Once things started to return to the 'new normal' and we started seeing patients return, started seeing elective surgeries back on the schedule, nothing else changed in terms of what we needed to do to protect ourselves, our colleagues, and our patients but all of a sudden, we were getting volume back in our tiny Manhattan space. Being able to adapt and deliver care as we did before to, hopefully, close to the amount of people we were able to deliver it to before, while keeping everyone, patients and employees alike, safe and comfortable is a real challenge to this day." - Department Director, major New York City Hospital

Patient Transport:

"Every day policies are changing. People are more educated now. We can move COVID-19 positive patients through the hallways pretty safely. We send out a transport alert. Security clears the hallways. The transport elevator is cleared. We have on full PPE and the patient is wearing a mask." - Nurse treating COVID-19 patients

"Transporting infectious patients with proper PPE on, or with tenting if needed, through the usual hallways for short periods of time should be fine. Given the ventilation that we have and the PPE that we use it would not be an issue. Where it gets hairy, is when you are sharing air space with someone who is COVID positive for a long period of time." - Department Director, major New York City Hospital



Hospital – Contributor Wish List

(#1 Adapt the Way We Work) Manage Infectious Patients

“Some recommendations are coming out suggesting totally separate entrances for the infectious and the non-infectious. I was thinking ‘Well, wait a minute. You don’t know who is infectious and who isn’t. You’re just letting the patient decide. We need to assume everyone is infectious.’”

– Marvin Williams, former ED Director, Senior Medical Planner, Associate Principal Perkins&Will

(#2 Increase Capacity) Add Waiting Room Space

“Chairs are 6’-0” apart with flip-down signs for the chair to be cleaned after each use. We use volunteers to monitor the area.”

– Nurse treating COVID-19 patients

“100% - first on the list is Waiting Room space. The waiting and the flow are interrelated. If we had patients coming in one way and exiting on the other side, there would be less congestion and it would allow more people to wait.”

– Department Director, major New York City Hospital

(#3 Provide Infection Control) Provide Isolation OR’s

“We are talking with surgeons on one of our projects about setting up one of the OR’s in a suite of 32 as an isolation OR.”

– Chuck Siconolfi, Regional Director, Principal Perkins&Will re: Nurse Anesthetist intubating patients in the ICU

“We bring patients mainly to the OR or to Imaging. An isolation OR would be really helpful.”

– Nurse treating COVID-19 patients

(#1 Adapt the Way We Work) Manage Infectious Patients

Hospital – Circulation



Assessor Station At Door

“Limiting the number of locations where people can come into the hospital while at the same time creating flexible greeter stations with quick-look nurses (or staff) allows for the separation of infectious and non-infectious patients. Anyone can safely enter without engaging or waiting with exposed patients.” – Marvinna Williams, former ED Director, Senior Medical Planner, Associate Principal Perkins&Will



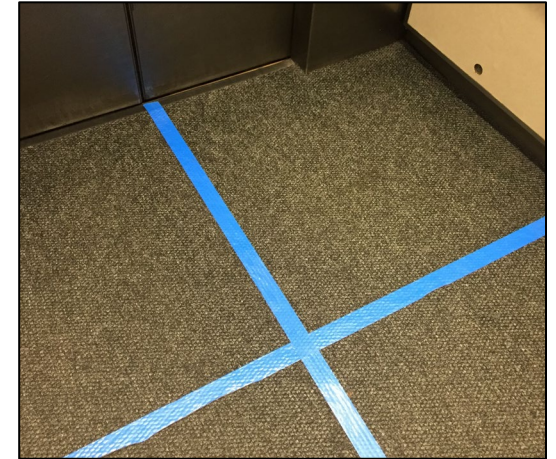
Provide Space Outside

“I helped plan a hospital which is set up for bio-terrorism and pandemics. We designed the ambulance bay sally port to allow suspected patients to be routed outside, tested and evaluated instead of letting them come inside the Main Lobby.” – Marvinna Williams, former ED Director, Senior Medical Planner, Associate Principal Perkins&Will



Safe Patient Transport

“We put a mask on them. The staff are wearing masks. We use the back-of-house corridors and elevators where the patients aren’t mixing with visitors. The patients aren’t going to be touching anything in the elevators. You’re not in the elevator very long so exposure is limited. So hospitals are already pretty much set up to limit the spread.” – Nurse treating COVID-19 patients



Ventilate Elevators

“Elevators have little or no air circulation. No air sanitization is employed at all. It is important to provide proper, continual, balanced circulation, removing contaminated air and replacing it with filtered sanitized air utilizing high efficiency filtering and UV-C irradiation.” – Elevator Cab Purification System Representative

(#2 Increase Capacity) Add Waiting Room Space

Hospital – Waiting



One-Way Flow

“The waiting and the flow are interrelated. If we had patients coming in one way and exiting on the other side, there would be less congestion and it would allow more people to wait.” - Department Director, major New York City Hospital



Separation

“In the ED’s, we’re talking about separation of waiting rooms so the person who comes in with a sprained foot isn’t sitting next to someone who is coughing. Or putting infectious patients on one side of the room separating them with plexiglass.” - Marvin Williams, former ED Director, Senior Medical Planner, Associate Principal Perkins&Will



Limiting Numbers

“Lots of front-line staff feel like the waiting is a problem. It clearly is because they are trying to introduce social distancing. There are two things that should be added to the discussion. Limiting the number of people in the hospital (i.e. just in time, telemedicine) The other thing is the ventilation.”
- Chuck Siconolfi, Regional Director, Principal, Perkins&Will

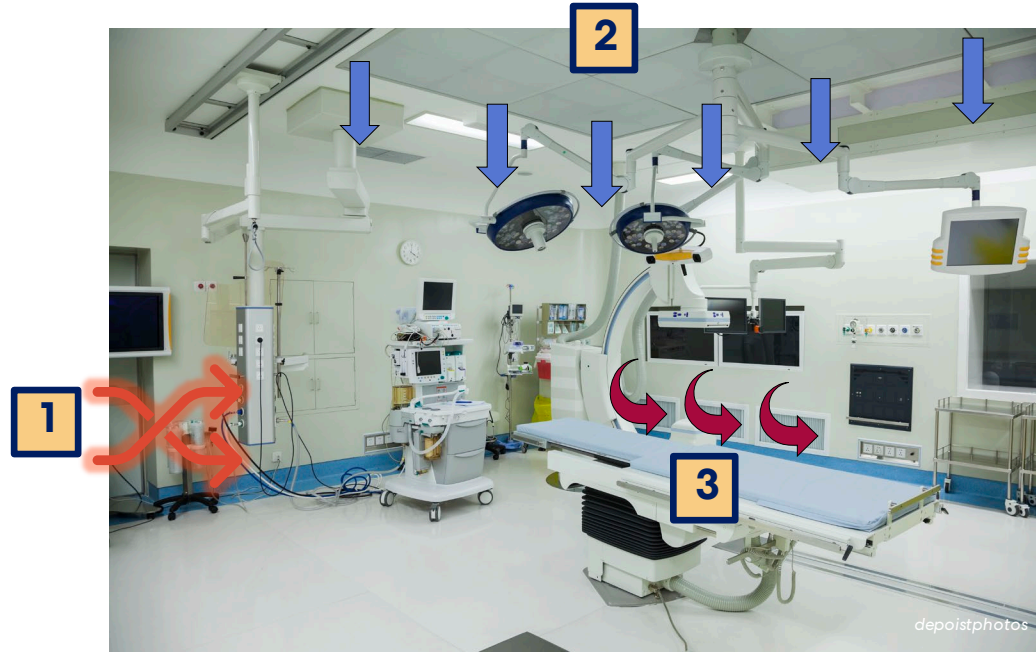


Provide for Visitors

“I’m working with a large trauma center client right now. We talked about designing a temporary building outside the hospital for visitors. So many places are making the visitors wait in their cars. It’s cold or it’s hot. There are no bathrooms in the parking lot.” - Marvin Williams, former ED Director, Senior Medical Planner, Associate Principal Perkins&Will

(#3 Provide Infection Control) Provide Isolation OR's

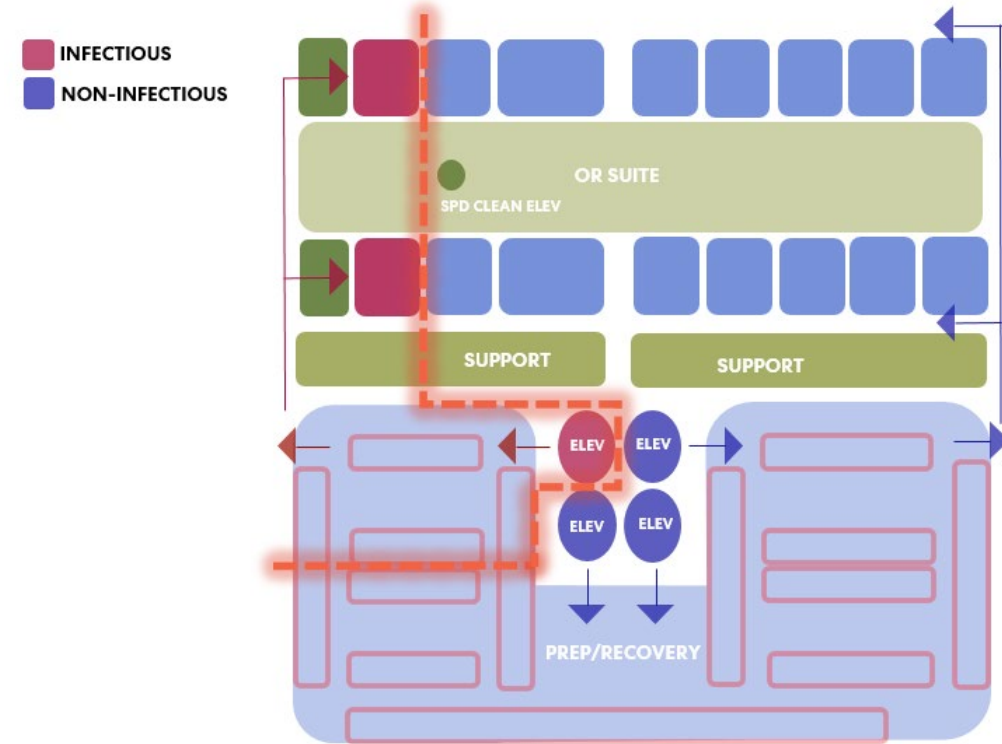
Hospital – Isolation OR



Isolation OR Diagram

(Negative Pressure, Dedicated HVAC)

- 1 Airtight/interlocking doors from Ante Room
- 2 Laminar airflow/HEPA filters/outside air supply
- 3 Low wall registers-high velocity/HEPA filters/exhaust to exterior



Flow From ICU to Isolation OR

(Dedicated: Elevator, Prep/Recovery, & 2 Isolation OR's)

“Nobody wants to shut down surgery. (During COVID) they did and they are dying (financially) because of it.” - Marvin Williams, former ED Director, Senior Medical Planner, Associate Principal Perkins&Will

Case Study: Minimizing Supply-Chain Shortages

New York City, COVID-19

“For better or worse, the supply chain difficulties experienced by the COVID-19 response have raised awareness of the critical importance of an effective supply chain. Reliable supplies of test-kits, equipment, pharmaceuticals, and PPE are essential to a continuous, successful response.” – Sean O’Neil, Executive Vice President, St. Onge Company (multiple quotes this page)

Consolidated Service Center:

“The current operational approach focuses on a just-in-time model, where hospitals and health systems rely heavily on their distributor(s) for daily deliveries of primary medical and surgical supplies. A recent trend has created the same capability through a system-owned Consolidated Service Center.”

Manufacturers	Resupply Source	Secondary Source	Primary Source (Unit/Bedside)
Supplier Base	Local Hospital Storeroom	Clinical Unit Supply Rooms	Point-of-Use Carts, Servers
	Low Unit-of-Measure <ul style="list-style-type: none">Distributor-managedHospital-managed	STAT Storeroom	<ul style="list-style-type: none">Clinical Unit Supply RoomsPoint-of-Use CartsNurse Servers
	Consolidated Service Center <ul style="list-style-type: none">Distributor-managedHospital-managed	STAT Storeroom	<ul style="list-style-type: none">Clinical Unit Supply RoomsPoint-of-Use CartsNurse Servers

Avoid Reacting – Plan The Response:

“We must work with the hospital team to ensure there is not an overreaction to store significant inventory on site (at a potential loss of revenue generating space). Someone in leadership might declare, ‘We need to stockpile 90 days of supplies.’ Teams. need to develop a pandemic inventory response strategy that incorporates the upstream supply chain capability, product shelf life, expiration, stock rotation and available space to determine the resulting pandemic response inventory position at an item level. Mitigation plans should evaluate off-site or contracted disaster response inventory and consider reusable and sterilized product options.”



Technology Solutions

“Some people call technologic devices ‘toys.’ These can be expensive devices and, until you deploy them properly, they kind of are toys. It’s all about the workflow, understanding where the danger points, are and saying, ‘there’s a technology that can reduce the risk or replace that part of the workflow with something else.’”

- Phil Crompton, Vantage Technology Consulting Group



Drones

“You could deliver a surgical tray with a drone quite easily. Since the drone can’t fly inside the hospital, I assume it would be a roof-based thing like the heli-pad.”

- Phil Crompton, Vantage technology Group (multiple quotes this page)



Contact Tracing

“If you badge everybody and it turns out someone does have COVID we can do contact tracing. You can see everyone they have come into contact with using an RTLS badging system. They call it breadcrumbs. You can follow their tracks.”



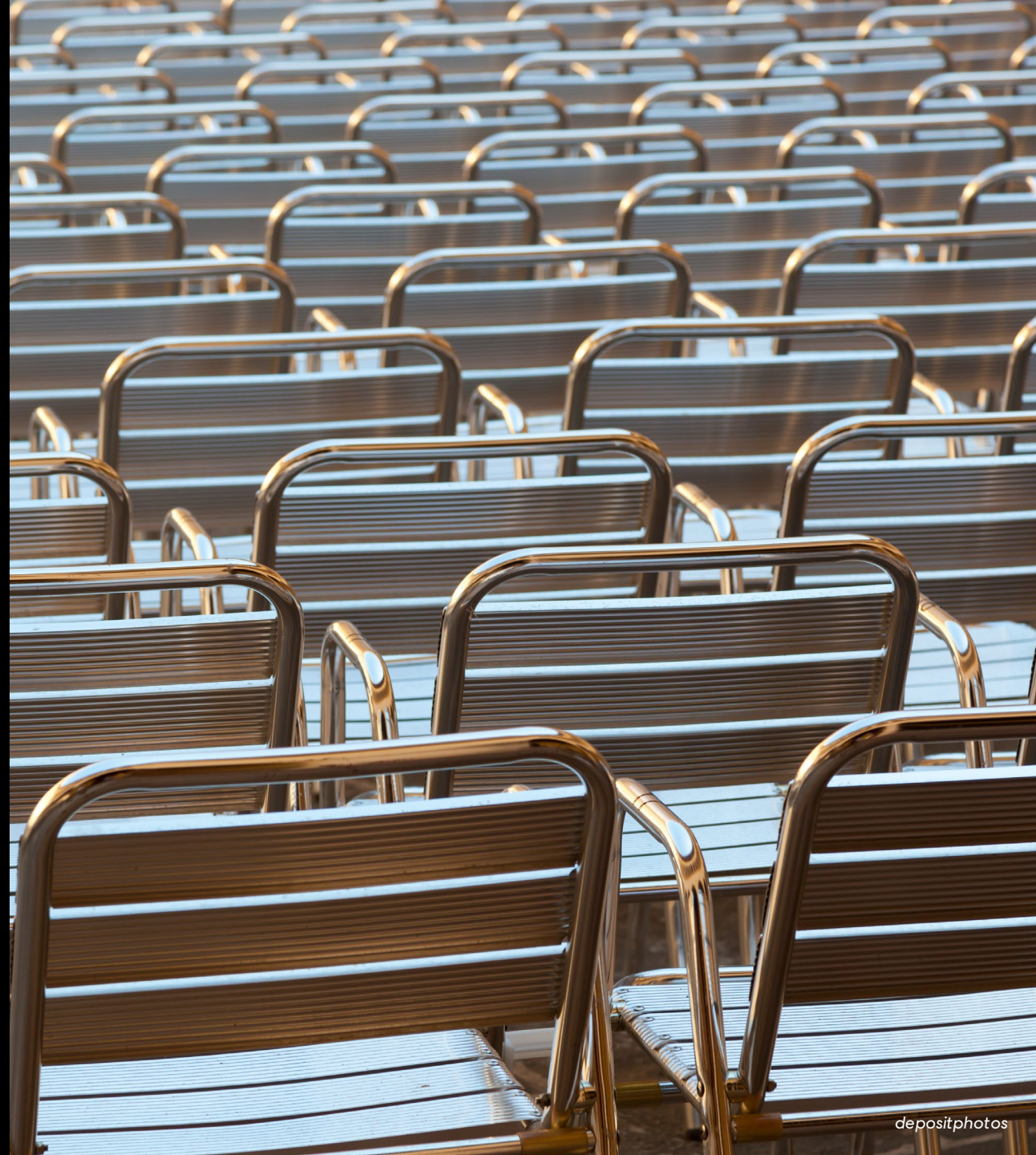
Touchless

“There’s lots of touchless things we can do. That just needs to be standard design full-stop in my mind. We should never have another press-plate in a hospital. Now, we can just wave our hands in front of them and they do the same thing.”

Space Program

'The COVID -19 pandemic is an event that is unique in human history. Developing a program to help people respond is important.'

- Chuck Siconolfi, Regional Director, Principal, Perkins&Will



Space Program

Testimonial:

It's early June, Phase 1 Re-Opening in Manhattan. I'm driving in from Westchester for physical therapy. If I hadn't shattered my arm before the surge I would not be here but I can't blow this off. I reach that moment when I can finally see the skyline and, instead of getting that usual little beat of excitement from the sheer enormity of it, I suddenly have a knot in the pit of my stomach. I haven't set foot here since 20,000 people died. Sure I had COVID, but immunity isn't guaranteed.

As I reach the FDR expressway, I have my windows rolled-up tight. Can COVID hitchhike on air flowing through the city streets and leak in? I don't know. So many things I've been told about COVID have been proven wrong at this point. I don't believe anyone knows. As I reach Exit 13 for 71st St, I realize I'm going to valet my car and I need to put on my mask. Do I put it on now? Do I wait until I get there? I haven't been wearing a mask this whole time so the air in my car is contaminated. Was I supposed to? What is the protocol here?

At this point, I'm pretty stressed out but it's not until I get out of the car and find myself in front of the door to the elevator lobby with a handle that I'm going to have to TOUCH to open that I realize I am REALLY not prepared for this and I'm going to have to seriously figure some things out or I'll be in big trouble...

- Author, COVID-19 patient

"A voice inside my head just kept screaming, "Don't touch anything!"

- Author, COVID-19 patient

Space Program:

To ensure the highest standard of baseline Critical Care is incorporated, the following Infectious Pandemic Surge Space Program was developed using a Perkins&Will Traditional best practice ICU Unit Space Program as it's foundation (created by Jeff Dreesman, Healthcare Practice Leader Western Region Perkins&Will). The Pandemic Surge Program is represented side-by-side with the Tradition Program and the resulting additional SF investment is calculated.

Space Program

Meeting The Need

The Need:

The journey documented in these pages began with the desire to identify a need. This led to countless conversations with front-line workers, designers, strategists, and various experts. It continued through many nights of research, synthesis, and formulation.

Simply put, the need identified through this effort is for an ICU Unit that is designed to be prepared to respond to an Infectious Pandemic and is reasonable (financially, operationally) for hospitals and systems to build (or adapt).

Meeting The Need:

Meeting the overall need in a way that hospitals can afford and operate means leveraging the assets provided in a traditional ICU Unit design to allow the Unit to flex in times of Infectious Pandemic Surge. This means that many of the components that make up the regular ICU will have dual-functions. Some Examples of this strategy are:

- Rooms that will not be used during a pandemic, (i.e. Waiting Rooms, Patient Education (Multipurpose in California), Consultation) will be used for additional storage, work, and respite areas.
- Smoke Barriers will double as infection control barriers when flexing a unit for Isolation (dedicated support vs. support shared between units is required).
- Patient Room headwalls and booms will be situated to allow 2 patients in 1 room without impacting day-to-day workflow. Rather than doubling-up on these expensive services, additional outlets will be added to augment capacity.
- Work areas will be configured for maximum efficiency and to keep staff safe in day-to-day as well as flex pandemic circumstances.

Infectious Pandemic Surge Program - ICU - Flex Isolation Unit

Change from Traditional Program to Allow For Unit to Flex to Pandemic Surge Condition							
Intensive Care Unit	Traditional Unit	Traditional Unit	Total NSF	Pandemic Surge	Pandemic	Total NSF	Comments
12 Bed Unit	Quantity	NSF/Room		Quantity	Surge NSF/Room		
Patient Care							
Patient Room, Private	11	300	3,300	10	300	3,000	Optional - Provide Bariatric Room
Patient Toilet	11	40	440	10	40	400	
Patient Toilet (Accessible)	0	60	0	0	60	0	ADA toilet provided in Isolation
Patient Room, Isolation	1	300	300	2	300	600	Optional additional Isolation Room for use during smaller outbreaks.
Patient Toilet, Iso (Accessible)	1	50	50	2	50	100	
Ante Room	1	60	60	2	60	120	
Gurney Shower Room	1	80	80	1	80	80	
Caregiver Substations	5	15	75	5	24	120	Between every 2 Patient Rooms.
PPE Cabinet	5	2	10	5	2	10	
Multipurpose Room	1	180	180	1	180	180	Can be outside the Unit. Flex for Central Pandemic Storage, Work or Respite.
Patient Toilet	1	40	40	1	40	40	
Sub-Total NSF			4,535			4,650	
Patient Care Support							
Unit Ante Room	0	0	0	1	90	90	Corridor space not included in SF.
Handwashing Station	0	0	0	1	10		
PPE Cabinet	0	0	0	1	2		
Caregiver Station	2	180	360	3	170	510	
Handwashing Station	2	10		4	10		
Pneumatic Tube Station	1	10		1	10		
Point of Care Testing	1	10		1	10		
Crash Cart Alcove	2	10		3	10		Pandemic Surge NSF incorporates social distancing.
Workstations	12	10		12	18		
Printer/Copier Alcove	2	15		3			
Clean Supply Room	1	160	160	1	195	195	
Alcove, Clean Linen	1	30	30	1	30	30	
Soiled Utility Room	1	120	120	1	175	175	
Medication Room	1	120	120	1	150	150	
Nourishment Room	1	100	100	1	100	100	
Storage Room, Equipment	1	240	240	1	300	300	
Storage Room, Specialty (Rehab/RT)	1	80	80	1	100	100	
Alcove, Imaging Equipment	1	30	30	1	30	30	
Wheelchair/Stretcher Storage	1	15	15	1	15	15	
Housekeeping Room	1	60	60	1	80	80	
Sub-Total NSF			1,315			1,775	
Staff Support							
Staff Lounge	1	240	240	1	240	240	Exterior terrace space not included in NSF.
Staff Lockers	1	40	40	1	40	40	
Staff Toilet	2	50	100	2	50	100	
Workroom, Care Team	2	180	360	2	225	450	
On-Call Room	1	80	80	1	80	80	Can be outside the Unit.
Staff Toilet/Shower	1	80	80	1	80	80	Can be outside the Unit.
Offices	2	100	200	2	100	200	
Quiet Room, Staff	1	100	100	1	100	100	
Quiet Room, Lactation	1	100	100	1	100	100	
Sub-Total NSF			1,300			1,390	
Public Areas							
Family Waiting	12	20	240	12	20	240	Calculated using NSF per seat. Outside the Unit. No waiting during Pandemic. Flex for Work or Respite.
Resource/Patient Education	1	60	60	1	60	60	Outside the Unit. No outside consultation during Pandemic. Flex for Work or Respite.
Consultation Room	1	120	120	1	120	120	
Toilet, Male	1	80	80	1	80	80	
Toilet, Female	1	80	80	1	80	80	
Fountain, Drinking	1	15	15	1	15	15	
Phone, Public	1	15	15	1	15	15	
Vending Alcove	1	40	40	1	40	40	
Sub-Total NSF			650			650	
Total NSF			7,800			8,465	
DGSF Multiplier			1.60			1.60	Additional mechanical space for dedicated Isolation Unit HVAC not included in DGSF.
Total DGSF			12,480		(Delta = + 8% DGSF)	13,544	1,064
DGSF/Key Room			1,040			1,129	Standard Range: 850-1100 SF/Bed

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