



introduction

As some of our communities emerge from the current COVID-19 crisis, while others brace for a second wave, we have a rare opportunity to review what we have learned in the past several months. With Emergency Departments serving as the front door to the Hospital, all patients, staff, and healthcare providers are heavily impacted by the COVID-19 pandemic. We aim to review current challenges and apply innovative thinking to design solutions that will help each other cope with future threats to our communities and healthcare providers. Now is the time to strategize futureforward solutions as well as small changes that can be made today for our healthcare systems.

COVID-19 will undoubtedly transform the way we design healthcare spaces. Emergency Departments must be prepared, whether it be a COVID-19 resurgence, or a future pandemiccausing disease, with ways to safely separate and treat high-risk patients, yet remain open to allow low-risk patients to visit without concern of contracting an infectious disease. Science, data, and technology will influence the design process, with the focus being safety, infection control, and improved patient outcomes. Emergency Departments must remain open to all patients and protect those being treated, those visiting their loved ones, and the staff, volunteers, and healthcare providers.

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design & planning considerations

As COVID-19 has become our new reality, lessons have been learned from the first wave of the pandemic through information received from research and regulatory agencies, insights from our front line workers, and by the implementation of immediate design responses. From this, new approaches in the planning and design of the Emergency Department have emerged.

Whether it is retrofitting an existing Department or constructing a new facility, the following components and concepts have emanated:

- A "First Look Screening" that's placed at the entry to immediately identify and separate highrisk and low-risk patients
- Establish one-way circulation that includes separate entry and exit points to and from the ED
- Install new technologies for rapid evaluation that include infrared cameras at the entry to take the temperature of incoming patients
- Clear and prominent placement of PPE and hand wash or sanitization stations at locations that include the ED's entry, exit, common/shared areas including waiting, and throughout the treatment areas
- Utilization and installation of non-porous, easily-cleaned materials wherever and whenever possible
- Install or upgrade the HVAC systems with negative pressure and low return (laminar flow), especially at high-risk and other areas where both high-risk and low-risk patients may co-mingle.
- Use of UV technology, for both lighting and HVAC systems that will provide another layer of decontamination
- Establish a hands-free environment via voice activated and hand wave systems
- The removal of water fountains and utilize water bottle dispensers and other similar devices that eliminate a direct communicable exchange
- Install glazing, screens, and other devices at transaction zones and teaming stations for protection of staff, patients, and visitors
- Maximize surge capacity capabilities for both within, and outside the Emergency Department and provide appropriate support services (water, electricity, med gas) for these areas
- Signage that clearly identifies social distancing requirements, maximum occupancies, and wayfinding that directs patients to high-risk and low-risk stations





patient flow concept

Improvements in patient movement through the Emergency Department is essential in providing effective management of contagious transmissions. Establishing clear and effective social distancing, and immediate separation of "low-risk" and "high-risk" patients are the key to facilitate a better process, quality of care, and safety for patients, visitors, and staff.

When addressing the Patient Flow:

- Clear, one-way circulation, and separating the department's entry and exit
- Effective registration process. Better protocols of admissions and discharge •
- Avoid overcrowding waiting areas and cross-contamination
- Screening at ambulance entry to facilitate diversion decisions
- Improved HVAC systems with negative pressure and low return (laminar flow) at "high-risk" areas, and areas where both high-risk and low-risk patients are co-mingling such as entry and exit point of the department



FOLLOW JANE

Jane is exhibiting a few symptoms of a contagious infection and may be considered "high-risk".

FOLLOW JOHN

John is not exhibiting any symptoms of a contagious infection and may be considered "low-risk".





prototype: ED of the future

To further the improved concept of Patient Flow, a prototype for an ED of the future is envisioned.



arrival sequence

EDEXIT

The importance of establishing the right path for the movement of high-risk vs. low-risk patients is vital. The arrival sequence is redefined.

- Immediate clear wayfinding for high-risk and low-risk starting at entry and continues throughout the department
- "First Look Screening" rapid assessment for "high-risk" or 'low-risk" triage
- Clear and visible access of PPE with hand wash or sanitization station

ÉCEPTION

ESTIBULE

ED WALK-IN



vestibule | reception: high-risk & low-risk determination

A welcoming and non-invasive environment where science and technology assimilate with the design that will lead the effort in gathering, processing, and analyzing information.

Common elements for this area include:

- Clear and visible placement of PPE with hand wash or sanitization stations
- Far-UVC lighting systems for decontamination
- Negative pressure and low return (laminar flow) HVAC systems
- Hands-free activated environment

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- Non-porous, easily-cleaned materials throughout
- When operating at surge capacity, provide front-end triage at vestibule or just outside entry for guick assessments

signage and wayfinding to direct patients to high-risk and low-risk stations in reception

infrared cameras to take temperature of incoming patients





provide clear signage and demarcation for maximum occupancy and social distancing at queue

"First Look Screening" prior to waiting and triage for separation of high-risk and low-risk patients

> glazing/screen at transaction zones for protection of staff



vestibule

waiting areas: high-risk & low-risk separation

Waiting areas for high-risk and low risk differ. Low-risk is more traditional whereas the sequence of high-risk provides safety in getting the patient diagnosed and to the right treatment area.

Common elements for this area include:

- Clear and visible placement of PPE with hand wash or sanitization stations
- Far-UVC lighting systems for decontamination
- Negative pressure and low return (laminar flow) HVAC systems
- Hands-free activated environment
- Non-porous, easily-cleaned materials throughout
- Eliminate water fountains with bottle dispensers
- Glazing/screen at transaction zones for protection of staff, patients, and visitors
- Provide clear signage and demarcation for maximum occupancy and social distancing at queue



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 waiting area as a control zone high negative air, flow, and movement

> high-risk individual holding room (between waiting & treatment)

> > floor patterns to indicate one-way direction & flow

seating layouts with social distancing in mind





triage: high-risk & low-risk verification

Establishing triage rooms that separate high-risk and low-risk patients and provide safety and privacy for patients, visitors, and staff.

Common elements for this area include:

Clear, one-way circulation

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- Clear and visible placement of hand wash or sanitization stations •
- Far-UVC lighting systems for decontamination
- Negative pressure and low return (laminar flow) HVAC systems •
- Hands-free activated environment
- Non-porous, easily-cleaned materials throughout
- In times of surge capacity, provide temporary outdoor screening station to provide triage and treatment immediately outside the Emergency Department



separate high-risk & low-risk triage rooms with nearby treatment areas

> single flow traffic/directional (in one way/out the other)



COVID-19 LESSONS LEARNED: PLANNING & DESIGN

treatment: isolation | containment

Treatment rooms within the ED are differentiated by the negative air pressure treatment for high-risk patients.

Common elements for this area include:

- Clear and visible access of PPE with hand wah or sanitization stations throughout
- Far-UVC lighting systems for decontamination •
- Non-porous, easily-cleaned materials throughout
- Improved HVAC systems with negative pressure and low return (laminar flow), 100% exhausted to outside
- Hands-free environment via hand wave and voice activated systems
- Glazing/screen at transaction zones for protection of staff, patients, and visitors
- Design and plan "Flex Zones," a series of sub-compartments, both physically and mechanically, that will allow flexibility within the Emergency Department where one or multiple compartments can isolate itself from other compartments and create separate treatment areas between "high-risk" and "low-risk" populations.

semi-private, three-walled, treatment bays with surge capacity readiness with additional medical gasses and equipment to support additional



additional isolation rooms that exceed minimum requirements, or design treatment rooms with HVAC, services, etc. as found in isolation rooms

> on-stage/off-stage planning approach, separate flow between staff and patient



discharge

Designated separate exit to protect recovered patients and visitors from crossing paths with newly infected patients.

Common elements for this area include:

- Far-UVC lighting systems for decontamination
- Negative pressure and low return (laminar flow) HVAC systems
- Hands-free activated environment
- Non-porous, easily-cleaned materials throughout

clear, one-way circulation, and separating the department's entry and exit

signage indicating "No Entry/Exit Only"



clear and visible placement of hand wash or sanitization stations



additional considerations: outside the ED & freestanding EDs

In addition to improvements within the ED, other components and strategies can be utilized beyond the boundaries of the department.

TELEMEDICINE CENTERS

Re-direct potential high-risk patients away from the ED for evaluation and treatment

- A cluster of cubbies or pods placed at a location close to the Emergency Department
- Rapid assessment to establish the next steps for the patient
- Alleviates capacity pressure for the Emergency Department .
- Reduce waste in resources and PPE

PATIENT SUBGE: MANAGEMENT & CONVERSION

Consider identifying strategies for surge capacity both within the ED and outside of the ED.

- Identify and improve soft spaces adjacent to the department that can receive an influx of patients that exceed the departments surge capacity. This can include the hospital's parking lot, parking garage, areas of assembly and conference rooms
- Locations can occur near the Ambulance Bay
- Utilize modular structures that can be easily stored and assembled
- Provide points of connections for supporting services and infrastructure (power, water, med gas, etc.)

FREESTANDING EDs

Aside from a typically smaller size and more distant access to other hospital based services, one of the biggest differences between freestanding emergency departments (FSEDs) and hospital-based EDs is the way patients arrive. Typically the patient population is almost entirely walk-in arrivals at FSEDs. This presents a greater potential for infection in what is likely a smaller space. How do you deal with potentially infectious patients walking into the main entrance and contaminating the primary point of patient intake? First and foremost it is important to completely exhaust the air in the entrance and waiting area out of the building. This eliminates the potential for air, even though filtered, from being delivered mechanically to other parts of the facility. While this is not the most efficient strategy from an energy perspective, devices like energy recovery wheels can decrease some of the lost heating/cooling energy from the air as it is discharged. In a situation like the COVID-19 pandemic, it is also helpful to plan for a second point of access that can be used temporarily by any patients who believe they may be infected. This allows for more direct movement into an infection isolation exam room.



Example of utilizing a parking garage adjacent to the Emergency Department, to triage and process patients to the next level of care.



ON-STAGE | OFF-STAGE ED

CONVERTED ED FLOORPLAN

Case studies provide us with:

- Solutions to challenges we are facing today
- Examples that can be analyzed for what is working and what is not
- Provides the opportunity to enhance design



case studies

Innova Mount Vernon Hospital, Alexandria, VA



On-stage/off-stage design is commonly seen in surgical suites to provide a clean environment that minimizes infection risks. This design does require more space (extra corridors) to provide the separation between care teams and family/visitor traffic, but it is a model of care that works well for Emergency Department design given the diverse and complex cases it's required to care for. This design also allows for additional precautions to be taken in the case of heightened threats of infection (one way flow of traffic, negative air suite design, and isolating a wing for contagious patient).

Benefits of an On-Stage/Off-Stage ED design:

- Patients and Family are only allowed into the off-stage area and never pass open treatment areas
- The internal flow (on-stage) for staff treating patient remains as clean as possible, no street traffic or infectious patients in the core area

converted ED floorplan

This Emergency Department was designed five years before the COVID outbreak, but included a zone of 10 exam rooms designed to quickly convert to a full-negative suite with 100% exhausted air to separate potentially contagious patients from the remaining ED areas.



conclusion

As the front door to the hospital, Emergency Departments need to be designed to support a safe environment for all sick and injured patients, staff, volunteers, and healthcare providers alike. In identifying the correct path for patients based on their symptoms upon hospital entry, and providing the adequate means for personal protective equipment, sanitization, and separation along the way, both high-risk and low-risk patients will continue their journey throughout the Emergency Department in a way that optimizes safety and provides effective control of contagious infection.

By creating and improving spaces through design, science, and technology, hospitals can protect their workers and the communities that they serve. Most importantly, we all must reflect on, and learn from, the impact that COVID-19 has had on us.

As highlighted in this report, there are several trends to explore when addressing Emergency Departments and infectious diseases:

- Improving the movement of patients through the Emergency Department, by creating separate paths or physical distance, between "high-risk" and "low-risk" patients
- Designating separate exits to protect those that are visiting or who have recovered, from crossing paths with newly infected patients entering the building
- Utilizing technology, hand-washing, and social-distancing measures in registration and waiting areas
- Controlling air-circulation and negative pressure ventilation in high-risk areas
- Optimizing first-assessments, either at entry or in ambulances via a redesigned arrival sequence





POST COVID-19 LESSONS LEARNED: PLANNING & DESIGN

For more information on COVID-19 planning, design, and implementation considerations, visit the COVID-19 Resource page on our website or contact info@e4harchitecture | 888.781.8441

e4harchitecture.com/covid-19-resource-page/



