Time is of the Essence for Hospital Design

Healthcare facilities need to implement immediate changes to protect patients, staff

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The current COVID-19 crisis is not the first global pandemic, and unfortunately it will not be the last. Time is of the essence as new facilities are being constructed around the world, and existing facilities are being modified in order to meet current needs. Therefore it is crucial for these facilities to consider certain design guidelines in order to slow the spread of disease as much as possible—not only during the current pandemic, but in preparation for possible future incidents as well. The design of a hospital or health care facility accepting patients for treatment needs to be able to isolate presumed or confirmed positive individuals from staff and other patients. The entry site for these facilities is the first line of defense.

"Ideally, not only 'suspected COVID-19' patients, but all patients wishing to enter health care facilities, are being screened by medical staff who are protected with personal protective equipment, to determine if the patient has any symptoms that may indicate that the patient may have COVID-19," says Samuel J. Reed, chief strategy officer/compliance officer at BSA LifeStructures. "Most commonly, temporary, tent-type facilities incorporate some type of temporary heat (depending only the medical facility location), referred to as Respiratory Care Centers or Forward Triage Areas, are being set up directly outside of hospital emergency rooms, ambulatory surgery centers, and immediate care centers. The purpose of the centers is to prevent someone who may or may not know that they have COVID-19 from entering the health care facility without proper precautions and unknowingly potentially contaminating other patients, family members and health care staff within the facility."

HVAC and HEPA systems

Hospitals are, of course, highly elaborate settings where particular HVAC system designs are required in order to maintain indoor air quality and safe temperatures, humidity levels, and air pressure for all inside. "There are other options that allow air from COVID-19 isolation patient rooms to be recirculated back to the COVID-19 isolation patient rooms. I have not included the recirculation option in the following list of requirements as I believe that there are, typically, other ways to create negatively pressured COVID-19 isolation patient rooms without recirculating air from the rooms, but exhausting all air supplied to the isolation patient rooms. I believe that it is beneficial to facilities that the waiver allows this option, as some facilities may not be able to obtain certain materials or equipment to allow them to exhaust air directly from all COVID-19 isolation patient rooms," says Reed.

He cites the requirements noted in COVID-19 National/ State Emergency Hospital Blanket Waiver: Conversion of Standard Patient Rooms to Negative Pressure Isolation Rooms (Revised), revised edition, issued by the Indiana State Department of Health on 22 March 2020, for patient rooms, typically intensive care rooms where hospitals anticipate treating COVID-19 patients:

1. The patient room shall be negatively pressurized to a minimum of 0.01 inches water column.
2. All air from the patient room shall be exhausted to the outdoors, ideally, directly from the patient room with temporary exhaust fans installed in the patient room window. These fans are mounted onto a lightweight housing fabricated from whatever materials are readily available to the facility.
3. All return air systems serving the patient room suite, or unit, are closed off so that no air from the unit is recirculated or returned to central system air conditioning units.
4. The exterior of the facility must be looked at to determine how close the patient room windows, now exhausting air, may be to facility entrances, parking, and building HVAC outdoor air intakes. It is preferable to keep exhausted air 25 (twenty-five) feet or greater from any other air from any of these items.
5. Patient rooms that have a toilet/bathroom that can be directly accessed from the patient room are preferable.
6. Existing HVAC air conditioning systems can still supply clean air to the COVID-19 patient rooms with the above noted modifications in place. If the HVAC system has the capability of supplying 100 percent outdoor air to the COVID-19 patient rooms, this is preferable. This also ensures that other spaces, other than the COVID-19 patient rooms receive clean fresh outdoor air.
7. Due to the design and layout of patient room suites, or units, and due to medical staffing, it is almost a requirement to retrofit entire patient room units into COVID-19 patient units. In many ways, retrofitting an entire unit requires less measures to be taken to convert the unit, than if part of a unit were to be retrofitted.

As far as HEPA systems go, says Reed, "If individual patient rooms are exhausted directly to the outdoors, HEPA filtering is not required." He continues, "I would not recommend exhausting air from a COVID-19 isolation patient room, filtering the exhaust air with a HEPA filter, and then supplying the HEPA filtered air back into the COVID-19 Isolation Patient Room. I am recommending that health care facilities exhaust the air supplied to COVID-19 isolation patient rooms directly to the outdoors from the isolation patient room with temporary fans, temporarily installed in the isolation patient room windows."

Gowning areas and PPE equipment

Hospitals across the US are experiencing critical shortages of personal protective equipment (PPE) as they treat COVID-19 victims. Hospital staff, who are already accustomed to proper donning and doffing procedures, must be extra vigilant in these trying times about the way that they put on and take off their apparel, so that nothing goes to waste and they are not accidentally exposed to the virus.

Reed notes that, at this time, hospital infection control staff that he and his colleagues have worked with are not requiring that COVID-19 isolation patient rooms have a dedicated anteroom for gowning and changing. "Presently, before leaving the patient's room or cubicle, medical staff remove and discard PPE following CDC Guidelines for safe donning and removal of PPE; gowns, mask or respirator, goggle/face shield; gloves. The exception to this is the PPE equipment that they are trying to conserve due to lack of supplies that is being predicted and being experienced in some areas," he says.

He describes another strategy designed to help limit staff exposure and PPE usage: "One of the more innovative ideas that I have heard is to locate patient IVs in the corridor outside the COVID-19 isolation patient room so that the isolation patient room door is not required to be opened and closed each time an IV machine requires attention. This is easier or more difficult to accomplish, depending on the design of the patient room. Many existing ICU rooms would easily be able to accommodate this idea."

Use current facilities or new ones?

Is it better to bring patients into an existing hospital, or to build pop-up tents and other similar facilities outside of a hospital building to minimize potential exposure?

Reed notes that outside facilities have their advantages: "Testing and checking patients' vitals, to determine if patients have COVID-19 symptoms, is being done, whenever possible, outside of health care facilities prior to allowing patients to enter the health care facility," he says.

Keeping things uncomplicated, Reed says, is another crucial design tactic to minimize the spread of a viral outbreak throughout a health care facility. "Many existing patient room suites/units can, with relative ease, be converted into COVID-19 isolation patient room units. The challenge is to keep things simple and not over complicate the modifications being made," he says. "Keeping modifications as simple as possible, but achieving the goal of creating negatively pressurized COVID-19 isolation patient rooms, is also being driven by time. There is no time to order new equipment and make major changes to existing HVAC systems. Changes need to be made immediately, not weeks from now."

Isolating COVID-19 patients

As COVID-19 patients are admitted to the hospital, they obviously need to be placed in secluded rooms with protective measures to keep the virus from spreading to other areas and people. Reed recommends that negatively pressurized isolation patient rooms are used to house COVID-19 patients.

"As we have all seen on the news, when single-patient isolation rooms are in short supply, the following principles for making decisions on patient placement have been published by the CDC in their publication entitled, 'Interim Infection Prevention and Control Recommendations for Patients with Suspected or Confirmed Coronavirus Disease 2019 (COVID-19) in Health care Settings'1:

Medical staff must prioritize patients with conditions that may facilitate transmission (e.g., uncontained drainage, stool incontinence) for single-patient room placement. An attempt is then made to place together in the same room (cohort) patients who are infected or colonized with the same pathogen and are suitable roommates." Reed concludes that such design considerations can make a difference in how hospitals and health care facilities operate during this critical time, and he is optimistic that these design changes support bringing to a close this health care crisis and protects patients and the medical staff caring for them.


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References

1. https://www.cdc.gov/coronavirus/2019-ncov/infection-control/control-recommendations.html#infection_control

This article originally appeared on Lab Manager, labmanager.com.

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