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Featured Article

Simulation Design Considerations 2.0: Optimizing Space and Operations

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Abstract

Background: Simulation facility design has progressed over the past decade. Many schools and hospitals have the need to build flexible, forward thinking simulation education spaces.

Method: Through the experience of designing and opening a multispecialty simulation facility, many lessons have been learned, and several innovative aspects of simulation center design, which make simulation facilities extremely flexible and usable, have been identified.

Results: This article focuses on design concepts that provide options for simulation facilities to be both functional and operationally sound.

Conclusions: When designing or modifying simulation facilities, specific design elements add to the functionality and flow of the space and should be considered in consultation with architects, builders, and planners.

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In 2008, Kyle and Murray edited a textbook, which included basic design concepts for simulation facilities. Although many of the design components discussed in the book are still applicable, technology enhancements have rendered some aspects obsolete. In 2010, Seropian and Lavey published their article outlining design considerations for health care simulation facilities. Since then, a number of architects have published white papers or other materials highlighting their recent designs and projects (Nelson, 2013; Schnuck, n.d.). Many of these publications advocate designing for the future and building flexible spaces but do not provide details on how to accomplish this. This article seeks to build on Seropian and Lavey's work and provide greater insight into design and operational considerations for future simulation facilities.

In the past 5 years, many simulation centers have been designed and constructed in hospitals and academic institutions with many lessons being learned. Although specific design considerations such as room layout and flow will vary depending on the objectives of the program and the population served, there are general details that are applicable across many environments. Although some new

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simulation facilities are being constructed in 20,000 or more square feet of space, many facilities have to fit into more constrained locations. In these facilities, flexibility is key and the design considerations that will be addressed are of the utmost importance.

Key Points

- Simulation rooms must be flexible and multi-functional.
- Dry erase paint allows for increased functionality by providing a writing surface in space constrained areas.
- Low cost, tablet based, sign-in forms improve data collection.

Simulation Manikins

Although a review of simulation manikins is beyond the purview of this article, considering the mechanism through which high-technology manikins operate is an important design consideration. Many newer manikins are self-contained units, with internal Wi-Fi routers, reducing the need for wired connections; internal compressors, reducing the need for noisy external compressors; and internal reservoirs, reducing the need for external fluid containers. However, although manikins are becoming wireless and tetherless, some still require physical connections to compressors or computers. The need to accommodate a variety of manufacturer's manikins is a design consideration that will be discussed in the following applicable environment.

Simulation Rooms

Seropian and Lavey (2010) identify two primary room layouts that designers can consider. First is the open learning environment, which can accommodate 25-50 people and hold multiple manikins and beds or can also be used for task training. Second is the simulation theater, which more closely replicates a specific simulation environment, such as an operating room or labor and delivery suite. In a recent publication, Seropian et al. (2015) identified the high-fidelity simulation room (not labeled by function, but rather by size), the control room, debriefing room, multipurpose classroom, standardized patient environment, medication room, storage room, prep room, specialized simulation skills laboratory, and home and other specialty areas as the rooms that should be considered when designing a simulation facility. The authors also state that classrooms can be designed ‘‘flexibly’’ to accommodate many types of configurations and learning. This article describes options for simulation designers to consider when trying to create this ‘‘flexible’’ space.

When constructing a simulation facility, it is important to think about what type of program may utilize the space. However, designers are cautioned that all possible uses will never be thought of and the space should be able to be transformed for future uses. For example, a hospital may initially want to use the simulation facility specifically for emergency response training, such as code team or trauma team training. However, the use of simulation almost always expands and may grow to include operating room personnel using the space for team training or nurse orientation, emergency room personnel needing to manage multiple patients at one time, or nonclinical environmental services staff being trained to properly clean a patient care environment. It is therefore important to construct at least one room that can accommodate all these activities. A 400-sq. ft. room ($20' \times 20'$) can comfortably accommodate two patients with headwalls and can be quickly transformed to resemble an operating room or other environment with minimal difficulty (Figures 1 and 2).

Although creating a highly realistic environment is one objective of simulation-based education, in space-constrained areas, simulation rooms should also be able to double as other types of learning environments, such as a debriefing room or task-training room. Although the likelihood of emptying a simulation theater is often impractical, having the flexibility to move equipment around to accommodate a debriefing setup or task training equipment is valuable. To allow for this flexibility, installing a monitor on a wall in the simulation theater and wiring it to a computer located in the control room, with additional connections in the simulation room, provides maximal functionality (Figure 3). The control room connections allow the simulation operator to display case information or ancillary materials, such as radiology images to the learners during a scenario. Having connections available in the simulation theater allows for a laptop to be connected to the monitor and display learning materials and/or video images during a debriefing or task training session.

When constructing a simulation theater that will accommodate a simulation manikin, consideration should be made to install a compressed air pipe/valve approximately 12″ from the floor. This valve can allow operation specialists to connect the manikins to an external air source, negating the use of noisy compressors located in the simulation environment and reducing wear on the internal manikin compressor (Figures 4 and 5).

Simulator connections are also important for designers to consider when designing a simulation theater. Simulation connections are still required for manikins not yet built or retrofitted with wireless connections. These may include USB, VGA, DE-9/DB-9 ports and/or stereo audio inputs. These connections should originate in the control/observation area, be routed through conduits in the wall, and terminate on the headwall. This setup allows a simulator to be controlled from the adjacent control room without wires running across the simulation theater floor (Figure 6).