THE DESIGN AND PLANNING OF MULTIDISCIPLINARY SIMULATION CENTERS

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Simulation Centers are gaining more prominence in the healthcare industry as teaching hospitals, medical schools, nursing schools and other healthcare educational programs adopt simulation-based training to supplement clinical training. Simulation Centers provide improved learning rates by placing students in a simulated patient-care setting, offering real-world training in handling medical scenarios in a safe, instructional environment that supports team-based care.

A typical Simulation Center promotes three training pedagogies:

- **Standard Patients Training**, in which actors play patients or family members as students practice interaction and communication skills.

- **High-fidelity Mannequin Training**, in which students practice different medical scenarios on an electronically controlled mannequin that simulates physiological symptoms, such as a heart attack, blood-pressure loss, or adverse medication effect.

- **Task Training**, in which students practice new technology in a hybrid “video game” format.

Task-training Simulation Centers have been an effective training tool for airline pilots, military-vehicle operators, and athletes for decades. Until recently, though, medical Simulation Centers were underutilized in the healthcare profession, often occupying left-over space in medical facilities. But today they have grown in size and sophistication with the increasing awareness of simulation training’s effectiveness.

Simulation Centers have made inroads in all aspects of healthcare education, and the number of Centers is expected to grow as medical technology and specialized-skills training become more sophisticated. In addition to medical schools and nursing schools for student training, healthcare organizations are using simulation centers as a professional development tools for physicians, nurses, caregivers, and new hires.

Simulation Centers provide improved learning rates by offering real-world training in handling medical scenarios in a safe, instructional environment that supports team-based care.
With the growing technical complexity of Simulation Centers, planning and designing a facility involves specialized expertise of healthcare professionals, architects, engineers, and audio-visual specialists. Simulation Centers contain five basic components, each representing unique needs, functions and design choices within this kit of parts:

- Lobby
- Simulation Room
- Control Room
- Patient Room
- Observation/Debriefing Room

Programmatically, these rooms are as technically complex as any room in a real healthcare facility. As such, architects and engineers need technical expertise in planning, programming and designing healthcare facilities to help Owners develop Simulation Centers tailored specifically to their organization’s educational needs and budget. Architects direct Schematic Design, Design Development and Construction Documents phases, right-sizing spaces, technology and infrastructure while monitoring building codes, regulations, construction issues and consulting with vendors and suppliers.

Just as in the design of actual medical facilities, astute planning ensures the space functions well and meets curriculum needs. But unlike actual medical settings, simulated environments act like theatrical stages, allowing students and staff to “suspend disbelief” and focus their attention on specific learning activities. The goal is to create a situation where people feel they are actually in the heat of the moment in a real-world medical situation.

Let’s look at individual component in more detail.

**LOBBY**

The lobby or pre-function space serves as an inviting area in which visitors, donors, students and instructors gather. As in any medical facility, this is the check-in area that orients visitors and directs them to their destination. The lobby sets the tone for the quality of instruction students will receive. It can even become another learning environment, where emergency conditions can be simulated in a setting mimicking a non-healthcare environment.

**SIMULATION ROOM**

Simulation rooms are the heart of any Simulation Center, flexibly designed to accurately portray the realities and drama of an intensive care unit, emergency room, operating room or other settings. Viewed from an adjacent control room or observation room, the simulation rooms include electronic mannequins that replicate patient scenarios. During an operation, for instance, the mannequins will develop symptoms consistent with a particular disease—and even react to a student’s operating procedure. A good designer will keep a clear focus on the relationship between the space planning and the functional application of the educational curriculum.
CONTROL ROOM
The high-tech control rooms allow instructors to manipulate the mannequins, adjust lighting or regulating sound to simulate in-the-moment medical situations. Instructors even can simulate power-outages or medical gas mix-ups so that students can practice crisis management during unexpected conditions. If possible, the control rooms should be raised off the floor to give educators a better view into the simulation room. Similar to control booths in a theatrical venue, operators in the Simulation Center’s booths control the lighting, sound and recording of dramatized events. When control rooms are raised, the spaces underneath can serve as storage.

PATIENT ROOMS
Next to the simulation rooms, the patient rooms are the most important curriculum-supported design component. In these flexibly designed patient rooms, actors or volunteers portray patients while a student practices bedside manners and team-based care. These rooms easily can be reconfigured into outpatient exam rooms.

OBSERVATION/DEBRIEFING ROOMS
Adjacent to the simulation rooms and patient rooms, observation rooms allow fellow students or instructors to watch through one-way glass. After the simulated procedure, students and instructors meet at conference tables to review progress. This peer review process helps build teamwork and camaraderie, emphasizing that healthcare delivery is a team effort.
While Simulation Centers need to create situations in which students feel like they are in the heat of the moment, determining the level of reality is often a balancing act. How real do things need to be? Does each piece of equipment need to be real and functioning, or could they just appear to be? The answer often depends on the individual curriculum and budget. But because most Simulation Centers are multidisciplinary, they need to be flexible enough to accommodate different scenarios and different “real” equipment.

Here are several infrastructure components to consider:

**CEILINGS**
A suspended structural unistrut ceiling system allows equipment easily to be added and moved within a room.

**ELECTRICAL INFRASTRUCTURE**
Because students will need to know how to operate advanced medical technology in critical life-saving situations, Simulation Centers should tie into the building’s overall electrical infrastructure to support integrated energy needs. For instance, consider the same energy requirements of an actual critical-care room or patient room when designing simulation rooms. By connecting the electrical through a relay panel system, building operators have complete control of the electrical and audio-visual systems, allowing flexibility to adjust power levels as necessary to simulate scenarios.

**FURNISHINGS**
Flexible furniture such as exam tables with locking casters, stackable caster chairs, modular folding tables, and tablet arm chairs that double as informal conference-room seating supports multifunctional spaces.

**HVAC SYSTEM**
In an actual hospital, the temperature and airflow varies from the operating room to the patient room. The HVAC systems should reflect these indoor climate variations so students become accustomed to working in different ambient conditions. And because Simulation Centers may be part of a larger facility infrastructure, they should integrate with the overall mechanical and plumbing systems for the most efficient, cost-effective results.
MEDICAL GASES
Because students need to learn how to operate and administer gases, there is often an educational value to using real gas. Laboratory-grade gas provides an acceptable substitute for medical-grade gas. The gas systems should allow students the ability to cross-connect different gases to evaluate the mannequin’s reactions to faulty gas systems. For some educational settings, compressed air can be substituted for “real” medical gases. And if budgets are tight, inoperative outlets are sometimes used, with a corresponding reduction in their training efficacy.

TECHNOLOGY
Proper lighting, functional medical equipment and electronically controlled mannequins all contribute to the theater of reality in a technically sophisticated simulation room.
The audio-visual system is one of the most important instructional components of a Simulation Center. The A/V system contributes to the theater of reality, enabling students to review their progress in instant playbacks while allowing other students to observe simulated procedures in progress across campus. When developing the audio-visual system, consider the following:

**INSTALLATION**

The audio-visual infrastructure includes cameras, microphones, speakers, display devices, and cabling. Installation typically begins after building construction is finished to avoid damage from construction dust and vibrations.

**NETWORKED INFRASTRUCTURE**

The Simulation Center needs to have a segmented network with firewall, in which computers, simulators and A/V are managed independently from the institution’s computers. Network cabling dedicated to the Simulation Center should have a different color code than standard network cabling.

**REMOTE ACCESS**

Any classroom, conference room or auditorium can access video feed from the simulation areas using a computer. Live camera streams allow students to monitor progress remotely, thus expanding the Simulation Centers’ benefits beyond its four walls.
Simulation Centers are about providing a safe yet challenging setting for students to master life-saving medical skills.

But do Simulation Centers improve students’ learning? Research suggests yes. For instance, a recent study at the Mayo Clinic Department of Surgery determined that hernia outpatients were 85 percent less likely to have complications and 63 percent less likely to be admitted overnight when operated on by a supervised training surgeon who had simulation training than by those who did not have simulation training. The report also concluded that surgical students receiving simulation training were six minutes faster, participated 15 percent more in the operative case, and demonstrated a higher level of operative skills than their peers who did not receive simulation training.

This research data and others confirm the educational benefits of Simulation Centers. Through proper planning and design, Simulation Centers help Owners eliminate patient risk while providing an effective educational tool for future medical leaders.

In addition to meeting educational goals, Simulation Centers often are viewed as significant contributors to recruitment, retention, and fund-raising goals. Top-notch prospective students, faculty, and staff are seeking institutions that understand the place of simulation in healthcare education, and who are willing to make the necessary investments to ensure that it is undertaken successfully.
Mayo Clinic Multidisciplinary Simulation Center
Rochester, Minnesota

The Multidisciplinary Simulation Center combines healthcare technology with a theatrical flair to simulate the real-life drama of a hospital. The 10,000 SF Simulation Center includes an entrance lobby, four simulation rooms, six patient rooms, control rooms, observation/debriefing rooms, conference room, offices, and integrated audio-visual technology. A wood-paneled lobby leads to four technically sophisticated simulation rooms that accurately portray the medical drama of operating rooms, emergency rooms, intensive-care units, and endovascular labs.

Instructors manipulate mannequins from an adjacent control room, adjust lighting, sound and mannequins to replicate various patient scenarios. The simulated procedures continue into the flexibly designed patient rooms, which can be arranged as inpatient rooms, examination rooms, or debriefing rooms where actors stand in as patients as students practice bedside manners. Fellow students observe their classmate’s progress in adjacent observation rooms.

KEY FEATURES

- Networked audio-visual system enables students to review their recorded procedures.

- Flexible furniture with casters moves easily for different medical settings.

- Vinyl Composition Tile (VCT), carpet, wood paneling, vinyl wall covering, solid surfaces create inviting environment.

- Acoustical wall and ceiling panels address critical sound control issues.
The Clinical Simulation Learning Center is part of Viterbo’s new School of Nursing building, which also houses the departments of public health, dietetics and nutrition. The 68,777 SF building is divided into a five-story wing and a three-story perpendicular wing. The five-story wing includes the main labs and classrooms. The three-story wing houses a Conference Center with 150-seat lecture hall, 100-seat flexible classroom, nutrition labs, classrooms, and Clinical Simulation Learning Center. The facility provides common spaces for students and faculty to collaborate and discuss, providing a strong sense of community.

The Clinical Simulation Learning Center includes four state-of-the-art labs for critical care, medical/surgical, maternal/newborn care, and child health. Each lab includes an observation/debriefing room and control room monitored by faculty who simulate patient responses using electronic mannequins. Interacting with simulators promotes on-the-spot feedback to enhance critical thinking and clinical decision-making skills.

KEY FEATURES

- Interactive learning environments that mirror hospital environments.
- Lecture halls and seminar rooms.
- Multipurpose classrooms/labs/computer-testing lab.
- Nutrition and food sciences lab.
- Integrative therapies lab.
- LEED® Silver Certification goal.
The Clinical Skills and Simulation Skills Center builds upon George Washington University’s existing program by integrating medical simulation to meet current and future educational needs and evolving technology. Built on the 4th floor of Ross Hall, the 17,000 SF facility replaces an existing Simulation Center on the 6th floor of the nearby hospital by expanding the footprint 50 percent with enhanced simulation components that allow students and clinicians to perform advanced surgical simulation.

The Simulation Center includes inpatient/outpatient rooms, centrally located control rooms, debriefing rooms, wet lab/dry lab, high-acuity simulation rooms utilizing electronic mannequins, reception, administrative offices, break-out space, and storage.

The project integrates with the building’s existing mechanical systems. Primary users will include medical and health-science students, residents, fellows, and practicing staff for educational purposes and professional development when it opens in spring 2014.

**KEY FEATURES**

- Standardized patient exam rooms replicate actual healthcare setting for procedural training.
- Simulation rooms.
- Control rooms.
- Lab space.
- Fixed and configurable conference rooms.
- Faculty offices.
The Hennepin County Medical Center Interdisciplinary Simulation and Education Center (ISEC) provides a guided, safe environment for healthcare professionals to practice real-life medical situations and procedures. Participants learn proper techniques, refine interpersonal skills and build confidence in their abilities. As a multidisciplinary training center, ISEC conducts educational programs for nurses, physicians, pre-hospital providers and other allied health professionals from HCMC, as well as community groups from across the region.

The 10,000 SF Simulation Center uses a full range of state-of-the-art learning modalities to provide the most realistic hands-on education possible. Simulation rooms are wired with video and monitoring capabilities and one-way glass for observation. The first phase completed in 2012 consists of two high-fidelity rooms designed to simulate ICU, emergency trauma and operating room scenarios, supported by conference rooms, education space and a training room. The second phase will add two more high-fidelity rooms and education space when completed in 2014.
Morningside College Nursing and Education Simulation Center
Sioux City, Iowa

The Simulation Center at Morningside College is part of a new 35,000 SF academic village housing the school of nursing, school of education, interdisciplinary agricultural industries department, and student advising within a single building. The four-story brick building features state-of-the-art learning environments, including experiential learning labs, simulation suites, departmental offices, resource centers, collaboration spaces and central commons to meet the demands of increased enrollment and recruiting goals. The building is connected to the existing Learning Center and Science Center, creating a hub of academic activity on the south end of campus near the historic campus lawn and recently completed pedestrian mall. Completion is scheduled for fall 2014.