JB is a 21-year-old male who was involved in a car crash. He arrives at the ED as a trauma code, and an ultrasound shows a large collection of fluid in his abdomen. He’s taken to the OR for an emergent exploratory laparotomy. The OR team prepares for the procedure, starting additional I.V. lines, arterial lines, infusing crystalloids, and obtaining uncrossmatched blood ready for transfusion. JB undergoes drug-facilitated intubation.

As his abdomen is opened, the surgeons find a large amount of blood and JB's BP drops. More crystalloid is administered and the first two units of uncrossmatched blood are transfused. While the team repairs JB’s lacerated liver and performs a splenectomy, JB undergoes massive transfusion, including units of packed red blood cells, platelets, and cryoprecipitate. After the surgery, JB is transferred to the ICU in critical condition for continued resuscitation and rewarming.

This is the seventeenth time this year this has happened to JB. He’s a human patient simulator in a simulated OR.

**Staying close to the VEST**
Simulation has been used for ages, from the ancient quintains (targets used by medieval soldiers to practice jousting), through modern, highly realistic flight simulators used by the airline industry to train and maintain their pilots’ skills. Human patient simulators such as JB are anatomically accurate manikins that are computer-controlled to provide lifelike simulations of real patient conditions. The Virtual Education and Simulation Training (VEST) Center at Christiana Hospital has a variety of patient simulators: six adult males (who can be changed into females) with differing capabilities, a child, a female who gives birth, and two newborns.
Students practice a mock laparoscopic procedure, including handling instruments for insertion into trocars.
Over the past 6 years, the VEST Center has evolved from a 600-square-foot simulation room, through a 1,100-square-foot “one-room schoolhouse,” to the current 9,260-square-foot, 7-bed simulated hospital (see A VEST Center time line). The floor plans for each of the rooms duplicate the plans of the actual hospital rooms, and the rooms are outfitted and stocked exactly as their counterparts in the hospital. This attention to detail provides a willing suspension of disbelief that lets participants believe they’re in the real hospital rooms, and act accordingly.

The VEST Center has rooms that simulate an ED trauma bay, an OR, an ICU, a two-bed patient room, two outpatient exam rooms, and an endovascular intervention suite. The center also has virtual simulators for endoscopy, laparoscopy, and hysteroscopy, and a clinical skills room for low- and medium-fidelity task trainers (such as I.V. arms for learning to insert catheters). Task trainers can be used to teach and assess psychomotor skills before they’re used on patients.

Why simulation?
Traditionally, nurses have learned and practiced in real clinical settings, which includes making mistakes on real patients. A simulated environment lets nurses learn, grow, be challenged, and even make mistakes without the possibility of patient harm. A simulation session can be video-recorded and played back later (a debriefing session) to show participants behaviors that they may have been unaware of during the simulation. Nurses can learn from mistakes made during a simulation session, and then repeat the session.

Nurses who learn only by what happens in the real clinical setting may not experience everything they need to learn (a phenomenon known as “education by random opportunity”). Simulation can be used to expose the learner to conditions and treatments that might otherwise be missed during the usual clinical training. Simulation scenarios can be created from basic, common experiences, or from rare experiences that few nurses ever see. Simulating the rare experiences prepares nurses for when these situations actually occur.

Also, training staff on new or infrequently used equipment is better demonstrated and practiced in the simulation OR than in the real OR. This way, the real OR isn’t taken out of service during a busy operative schedule, isn’t contaminated, and nurses don’t need to change into surgical attire just to attend an equipment demonstration. Working with the demonstrated equipment in the simulation OR allows for realistic interaction with the OR environment and multidisciplinary staff. The staff can be put through a series of “what if” scenarios to see how they handle the situations.

Patient simulators can be brought to the real OR for a simulation session, which lets the staff work in their own environment. The staff needs to know where to go to get the equipment and supplies they’ll need to take care of the “patient,” whether the case is routine, emergent, or clearly something out of the ordinary. Does the staff truly know where to go to obtain the one piece of equipment that’s rarely used, but needed immediately? Simulation can help accomplish these goals.

The simulation OR also is used to teach nonemergency basic perioperative nursing to both novice and experienced nurses and other allied healthcare providers. Due to the perioperative nursing shortage, our institution has been training perioperative internship students (new graduates as well as experienced nurses) in a formalized perioperative internship program for the past 10 years, as staffing the 56 major ORs and surgicenters in our institution has been a challenge. The perioperative internship program traditionally was held in a new surgicenter, didactic presentations given in a conference room and ORs used as available. OR space was very difficult to come by in this thriving surgicenter, so a space was created for an OR simulation lab. Unfortunately this simulation lab space was the construction shell area of two ORs that would be built in the future. The space was not well lit, and used as a storage room filled with equipment. An old extra OR bed, Mayo stand, and back
How simulation improves perioperative nursing

A VEST Center time line

- Fall 2004 — Opening of the initial simulation center, a 600-square-foot room in the Medical Arts Pavilion at Christiana Hospital. Equipment consisted of one adult and one pediatric human patient simulator and some basic equipment for patient resuscitation.
- January 2007 — The center moves to a 1,100-square-foot “one-room schoolhouse” in the new Ammon Medical Education Center at Christiana Hospital. The room is divided into four areas, including a generic clinical simulation space, office/control space behind a cubicle wall with windows, small classroom space, and space for laparoscopy and endoscopy simulators.
- January 2010 — Opening of the 9,260-square-foot expansion that includes a trauma bay, OR, ICU, patient room/labor-delivery-recovery room, two outpatient exam rooms, endovascular procedure room, clinical skills room (in the former one-room schoolhouse), two small classrooms, reception area, and staff offices.

Who uses simulation training?

In addition to the established perioperative internship program, many other perioperative programs have been instituted in the short time since the VEST Center expanded. Surgical technologists have been prepped for certification exams. Environmental Services practice turnover cleaning in the simulation OR without threat of creating a surgical site infection. Medical students on rotations such as OB/GYN and surgery have been taught proper surgical attire, correct scrubbing procedures, and the use of water-free skin antiseptics. Much attention is paid to detail as the medical students return-demonstrate donning and correct removal of gowns and gloves, and other skills. Medical students are taught the sterile areas of their sterile gown, where to stand, introduced to basic instrumentation, including identification, use of the instrument, and how to hold their hands for instrument acceptance.

Because the OB/GYN medical students will be practicing gynecologic surgery, a GYN instrument set is also opened and each instrument is identified and its use described. Some medical students request suturing instruction; the VEST Center is equipped with used patient simulator skin for students to practice suturing and knot tying.

General surgery and OB/GYN residents are able to practice laparoscopic procedures with an abdominal trainer, laparoscopic instruments, camera, and monitor. In the virtual OR, the patient simulator is draped and the Mayo stand and back table are arranged exactly the way they would be in the major OR, so the residents are truly immersed in learning the skills.

The Heart Vascular and Interventional Service have also used the VEST Center. A back-to-basics sterile technique program was developed with continuing education credits and return demonstrations for staff to review evidence-based practice and skills. Scrubbing at the virtual scrub sinks for competency assessment is easily accomplished in the VEST Center without interruptions that would occur in the real OR. Gowning and gloving can again be demonstrated, allowing practice then return demonstration in the virtual OR without stress or fear of contamination that could harm a patient.
Radiology technology students have also been taught in the VEST Center. All radiology students are required to complete an OR clinical rotation. The students are taught how to properly attire, along with the evidence to support the practice. They’re taught where to stand and what they can and can’t touch. Fluoroscopy machines can be draped, again without fear of contaminating a surgical field and potentially causing a surgical site infection. Radiographs of surgical sponges, suture needles, and instruments are available to demonstrate the radiographic silhouette of potential lost objects.

The anesthesia department has had a weekly block of time in the VEST Center for several years to practice anesthesia management of the critical patient. The multidisciplinary group consists of an anesthesiologist, two certified registered nurse anesthetists, a nurse anesthesia student, and an anesthesia technician. The team works together as they would in the OR to manage the patient. Scenarios include a pediatric patient with an airway fire, resuscitation of a pediatric trauma patient, cardiac arrest in the OR, management of a trauma patient requiring massive transfusion, and difficult airway scenarios. Working together as a team on difficult, infrequent cases, in a realistic, but nonthreatening environment, prepares all staff for a variety of situations, resulting in improved patient care.

Another program held in our VEST Center that’s absolutely vital to the future of perioperative nursing is a perioperative elective for second semester senior nursing students at our local university. The nursing students leave the university campus and come to the VEST Center for didactic and perioperative simulation learning. Skills learned throughout nursing school can be synthesized in this interactive elective. Basic perioperative nursing is taught in the virtual OR environment and clinical hours are substituted for class hours so students can experience scrubbing and circulating for actual cases. All perioperative evidence-based practice modules, such as surgical attire, scrubbing, gowning, and gloving, setting up a back table, loading and unloading scalpel blades, and suture needles can be taught in the simulated OR. A conference table and chairs can be brought into the large simulated OR for comfortable teaching purposes if needed. My colleagues may argue that wearing street clothes and bringing tables and chairs into the simulation OR can be confusing to the nursing students. This hasn’t been the case at our facility, but the issue is worth further study.

The VEST Center also serves the Explorer Scouts troop sponsored by the hospital. This troop consists of high school and college students interested in healthcare careers. Scouts come to the VEST Center to learn about perioperative careers, including nursing and surgical technology education, as well as anesthesia and physician assistant (PA) programs. The virtual OR is set up for the Explorer Scouts as if a surgical procedure is taking place. Explorer Scouts volunteer for the perioperative roles of surgeon, surgical resident, PA, and surgical technologist. The OR bed is draped with a chicken breast purchased from the grocery store, simulating the exposed skin of a patient. The Explorer Scouts are instructed to actually mark the incision site with a marker, properly wear a hat and mask, don gown and gloves, and operate on the patient—calling for the time-out, making an incision with the scalpel, dissecting tissue with surgical scissors, cut bone with rongeurs, then close the incision with blunt-needled suture and skin staples.

Dressings are applied and the Explorer Scouts correctly remove their gowns and gloves and wash their hands. This is a wonderful real-life experience for the Explorer Scouts as they’re introduced to the perioperative setting. In the VEST Center there’s no need to rush to leave the OR if it’s needed for an emergency, and a defrosted chicken breast can be used without

![Students conduct sponge, sharps, and instrument counts before a mock procedure.](image)
contaminating the OR suite. Instruments can be washed and dried in the VEST Center dishwasher without contaminating instruments used on patients.

The VEST Center is also an exciting way for members of the community to view an actual OR without changing into scrubs.

Preparing perioperative nurses
The program that uses all the different VEST Center rooms is the perioperative internship program. The patient room is used for prep and holding interviews, and the trauma room is used to assess the trauma patient before transportation to the OR. The novice students in this program spend 14 weeks in didactic, simulation, and clinical experiences learning theoretical knowledge, evidence-based practice, and specialized skills for perioperative nursing. This perioperative internship isn’t a preprogrammed learning experience, as the program is entirely face-to-face as the interns move through scrubbing and circulating roles with support and guidance from a dedicated perioperative educator/manager. Novice nurses are able to make the transition from novice to advanced beginner in the simulation OR in a supportive and nurturing environment. Learning how to set up a back table and drape a patient is more easily learned in the simulation OR with a simulated patient than sitting in a classroom. Patient positioning in the OR is more easily understood while practicing and performing on a patient simulator than with a makeshift OR bed in a classroom using desk and chairs.

In the simulation OR, the perioperative interns aren’t overwhelmed, easily develop necessary knowledge, and use critical thinking skills. Scenarios are introduced and feedback is constant until the intern feels comfortable. The interns can also be videotaped as they scrub at the scrub sink, and gown and glove in the OR, or videotaped setting up a table and draping the patient. This video can then be used in debriefing and critiqued by the individual intern and instructor or the entire class, promoting teamwork and collaboration. The perioperative interns are able to interview a patient in the patient room, transport the patient to the OR, and assist an anesthesia provider in placing leads and pulse oximeter as if they were in the OR suite.

Malignant hyperthermia, massive blood loss, cardiac arrest, traumas, and a host of other scenarios using the patient simulators can be played out in the simulation OR, again with no harm to a patient. These scenarios also test communication and leadership skills. In the simulation OR, the perioperative interns can step into the role of a perioperative nurse with its responsibilities and demands, and do so in a risk-free environment with no danger of injuring actual patients.

S(t)imulating future
Research is sparse on the use of a simulation OR for nonemergency scenarios, although students and staff practicing skills in the facility have reported newfound confidence and satisfaction with this unique learning experience. Cohort studies are underway in our institution to demonstrate this new high-tech way of teaching as the future way of perioperative teaching. Perioperative simulation will certainly attract new employees and will continue to grow—for example, simulation-based testing is being used to determine competency. Although simulation centers are costly and a perioperative internship program expensive, competent perioperative employees and improved performance will reduce errors and improve patient outcomes.

RESOURCES

In the Christiana Care Health System in Newark, Del., Chuck Fort is the simulation training coordinator in the Christiana Hospital Virtual Education and Simulation Training Center, and Beth Fitzgerald is the perioperative nurse internship manager.

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