

New ways to practice medicine

Teaching hospitals turn to mannequins and other simulators

By Liz Kowalczyk

BOSTON
Dr. Ruben Azocar hurriedly described the patient to two anesthesiology residents: A nurse leaving the night shift had been hit by a car and rushed to the operating room for emergency neurosurgery. The man was lying on a table, unconscious, blood dripping from his nose, a breathing tube down his throat.

As the two physicians-in-training began tending to the patient, he got progressively worse. The oxygen level in his blood plummeted and nothing they did seemed to help. They ticked off the possibilities: Foreign body in his throat? Lung spasms? Finally they threaded a tiny camera down his throat and saw the problem: The breathing tube had slipped.

This patient was not a real person — who could have suffered brain damage in the several minutes it took to diagnose the problem — but a mannequin named SimMan. Its vital signs were controlled by Azocar on a computer behind a two-way mirror. And in real life, a senior physician such as Azocar, director of the anesthesiology residency program at Boston Medical Center, would have intervened.

These residents are on the cusp of what some physicians predict will be a dramatic shift in how new doctors are trained. The guiding philosophy in medical education has long been that the best way for the residents to get good at something is to practice it on patients — with supervision.

But growing evidence about the frequency of medical errors and a better understanding of how adults learn is forcing physicians to rethink the traditional approach as part of the profession's broad efforts to improve care. Teaching hospitals increasingly are requiring residents to practice their skills on mannequins and other types of simulators, in some cases before ever touching a patient.

"Right now every hospital is set up to use human beings as teaching material," said Dr. Steven Dawson, a radiologist at Massachusetts General Hospital who builds simulators. "We have to find a way," he said, to allow residents to get that learning "without saying they're going to learn on my mother and your mother."

After the simulations, Azocar gave feedback about the residents' performance. Albert Woo, 30, and Joe McBrine, 31, both second-year residents, later said the simulated lessons offer an advantage over lectures. Woo said they are "burned into your brain," because the adrenaline surges just as it would in a real case.

"They're trying to expose us to things that don't happen very often in our day-to-day training," said McBrine,

'You know it's not real, but you still don't want the patient to die.'

adding that he has never seen a patient whose breathing tube had dislodged. "We were both caught up in the heat of the moment. You know it's not real, but you still don't want the patient to die."

Hospitals are using simulators both to train residents to perform specific procedures, like inserting an intravenous line into a major vein, and as part of role-playing to teach broader skills like negotiating disagreements about a patient's care. Doctors say simulators are particularly useful for training doctors to treat life-threatening conditions or perform risky procedures that are uncommon and therefore hard to master quickly, like cutting a hole in a patient's neck and inserting a breathing tube.

Beth Israel Deaconess Medical Center in Boston, which recently spent \$3 million to build a state-of-the-art simulation center, requires surgery resi-

dents to prove their competency on simulators before participating in laparoscopic surgery.

Starting last year at Boston Medical Center, surgical trainees must prove they have mastered tasks on a laparoscopic surgery simulator before participating in the surgery of an actual patient. These simulators try to mimic what it is like to operate through a tiny incision in the skin; residents, for example, practice using long instruments to pick up beads hidden inside a plastic torso and drop them into a cup.

Harvard Medical School is increasing simulation classes for students. And Children's Hospital Boston plans to require all surgery residents to participate in simulated cases on infant and adolescent mannequins when they start their three-month rotations.

"We're moving into an era where these simulators are going to be used to test competence," said Dr. Daniel Jones, chief of minimally invasive surgery at Beth Israel Deaconess, who introduced a requirement that surgeons hired to perform minimally invasive surgery demonstrate competency on a simulator first. "We're doing surgery; we want to know how good your hands are before you start."

Last week, Dr. Peter Weinstock, who helps run Children's simulation center, watched Dr. Adarsh Vasanth and Dr. Anthony Nichols, two otolaryngology residents, handle three simulated cases. He explained that trainees have been involved in several of the hospital's serious medical errors.

"I want you guys to really get into this," he told them.

The simulation room was set up like a real intensive care unit, including heart monitors, medication carts and oxygen machines. A mannequin lay on the bed. Hidden in an adjoining room, Liana Kappus, the simulation center coordinator, controlled the mannequin's vital signs and spoke into a microphone to produce its voice. Weinstock described the patient as Kevin Sanderson, an 8-year-old boy with



Dr. Ardash Vasanth, left, a resident at Children's Hospital in Boston, evaluating a child mannequin as Kristin Baum plays the mother.

severe lung disease. The mannequin's chest rose and fell and emitted raspy breaths through an oxygen mask. The mother, played by Kristen Baum, a medical student, held the figure's left hand and rubbed its arm. Vasanth and Nichols questioned her about Kevin's symptoms and then called in the senior physician in charge for his opinion.

They warned the mother that Kevin probably would need an operation. The voice coming from the boy mannequin said he was afraid.

"Come close so he knows you're here," Vasanth told the mother. "It's OK if you stay with him for now, but we might have to ask you to leave" if Kevin starts to worsen.

During the evaluation of how the residents handled the situation, Weinstock talked about a parent's role in calming a sick child: "In this hospital we would push the limit to keeping mom in the room," he said. "She might

be able to help you."

But the simulation made clear that existing technology has limitations — Vasanth and Nichols had to imagine a stitched-up incision on Kevin's neck, for example — and those gaps are a focus as physicians debate whether to use it extensively in hiring and promotion decisions.

There are few controlled studies that show whether simulation produces better doctors or whether testing physicians on simulators predicts how well they will handle a real patient.

Jones, of Beth Israel, said he tried to persuade physicians at several Harvard teaching hospitals to use simulation testing to evaluate residents applying for minimally invasive surgery fellowships, but they were concerned the tasks would not predict actual surgical skill.

"We need more rigorous validation," said Dr. David Brooks, director of minimally invasive surgery at Brigham and

Women's Hospital in Boston. "There are people who are superb surgeons who might not be the slickest person at picking up a Tic Tac candy and putting it into an opening."

Even without controlled studies, some doctors are convinced that simulation reduces errors and improves safety.

Three years ago Brigham and Women's Hospital began requiring internal medicine, emergency medicine, anesthesia and surgery residents to practice inserting intravenous lines using sterile techniques into major veins on mannequins before doing the procedure on patients. Since this and other improvements, the hospital's bloodstream infection rate from such lines has plummeted — from about 160 a year to about 30.

Dr. Richard Zane, vice chairman of emergency medicine at the hospital, said of simulators: "I am absolutely convinced they improve outcomes."

The Boston Globe