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No harm, no foul:

Putting theory into practice with high-fidelity simulation

After the Boston Marathon bombings on April 15, 2013, EMS responders and health care professionals at six hospitals knew what to do to save patients suffering from severe hemorrhage, bone fractures and burns. None of the hospitals were overwhelmed with the sudden influx of patients because health care professionals had honed their technical skills, interpersonal actions and problem-solving responses in mass casualty simulations years before the actual incident. As a result, all 140 victims treated in the aftermath of the incident survived.[1]

High-fidelity simulation has become an increasingly vital supplement to clinical education for all health care professions, including medical laboratory technologists (MLTs). It is an important learning tool in classroom labs for MLT students as well as for on-the-job training for MLTs working in laboratories. Scenarios provide learning experiences that emulate real situations with all of the visual, tactile, auditory and team interactions in context, but with no risk to patients.

At The Michener Institute for Applied Health Sciences (Michener) in Toronto, MLT students take a mandatory 10-week summer simulation semester before moving on to clinical placement. Operating much like a very large hospital laboratory, 64 student 'staff technologists' rotate 16 at a time through five different disciplines. "The main purpose of simulation is to provide a safe and innovative learning environment for our students in which they can simulate the routines, workflow and potential disruptions to those that they will encounter in their clinical experiences," says Peter J. Bridge, PhD, FCCMG, FACMG, Program Chair, Medical Laboratory Sciences (MLS) at Michener.

This focused approach to simulation education allows students to make mistakes without damaging patient specimens, build team problem-solving skills, and reduce time spent in clinical placement. The scenarios are realistic, since they are based on the professors' own experiences in the field, and students are continually evaluated across a number of technical and interpersonal skills. "We assess their professionalism as well as time management, communications and teamwork skills. We also look at safety, quality assurance and control," says Lorinda Ashley, Professor at Michener's MLS program.

One of the main challenges for high-fidelity simulation education is the hefty investment in equipment. At Michener, The CAE/Michener Centre for the Advancement of Simulation and Education (CASE) is a 20,000 square-foot, state-of-the-art learning facility, one of the largest simulation-based learning centres in Canada. Technology continues to change apace, but that offers additional learning opportunities. Dr. Bridge says, "We focus on giving our students a broad technology base so that they can operate whatever equipment they encounter regardless of where their clinical placement or ultimate job happens to be. New generation equipment can be used to demonstrate superior automation, higher throughput and more comprehensive interfacing with laboratory information systems. Previous generation equipment can be used to teach preventative maintenance, troubleshooting and, on occasion, fixing failures."

Technology is important, but simulation education is now focusing on understanding

Professor Gina Pinkowski reviews microbiology slides with a student. Photo credit: Michener Institute of Applied Health Sciences



LEFT: Simulated blood product used in the Mass Hemorrhage Protocol simulation
MIDDLE: Rhonda Shea, Simulation Consultant, pictured with Hal, a high tech simulation mannequin
RIGHT: Professor Mary Emes watches as students program a chemistry analyzer. Photo credit: Michener Institute of Applied Health Sciences

how students think and solve problems. Dr. Ann Russell, Senior Director of Learning, Innovation and Applied Educational Research at Michener, responsible for curriculum development and evaluation says, "There's a big shift in simulation education in health sciences from technology-based simulations to conceptual based simulations, shifting the priority from 'skill-and-drill' to cognitive task analysis. By assessing students' learning gaps in knowledge, skill, ability, attitude, or disposition, the goal is to find where, why and how errors happen, and how they are related to actual student cognition."

Michener's summer simulation semester is now in its eighth year.[2] Based on feedback from clinical partners, students are well prepared to step into clinical placement and if anything, may need a little reining in at times. "As the early leader, we have now had enough students pass through with and without simulation to demonstrate that simulation does in fact better prepare students for clinical readiness," says Dr. Bridge.

Across Canada, there are a growing number of simulation facilities popping up at major hospitals and research centres. MLTs working in remote and rural areas, however, do not have the same access as those working in larger settings. In a groundbreaking model, eSIM (Educate, Simulate, Innovate and Motivate) with Alberta Health Services (AHS) addresses that gap by bringing high-fidelity simulation education to the workplace.

Rhonda Shea, MA (CT), BSc (MLS), MLT, is a Simulation Learning and Development Specialist with eSIM. Her job involves setting up simulations at 44 hospital sites and a number of community health care sites in Alberta's North Zone, a large area that spans from Jasper to Cold Lake and from Edmonton to just shy of the Northwest Territories' border. "Most of the time, people go to a simulation lab that's set up like a typical patient room or an emergency room (ER) or operating room. There are many reasons why you would want to do that, however, I prefer the concept of in situ because the staff are familiar with the site. We can look for deficiencies in that environment and find them before a real patient comes, and people don't have to take time off work to do this," says Shea.

One of the simulations Shea takes to sites is Mass Hemorrhage Protocol. "It was a natural bridge for interdisciplinary participation, because we have an ER nurse initiate the scenario by calling the lab technologist to say that a mass trauma incident has occurred. The technologist then performs all the steps while we watch, including calling the pathologists, calling the unit back and analyzing fake units of blood," says Shea. "We have one scenario where there is nothing unusual and others where the samples are uncrossmatched. We include a variety of different distractors to make it more complex and challenging," says Shea.

Mass Hemorrhage Protocol is a high-fidelity simulation that operates exactly the same as a live system but without real patients. "That level of technological advance is wonderful. Without that, it would be very difficult to train somebody. Actually doing the computer steps is a completely different level of learning than just verbalizing them," says Shea, "During the scenario we don't actually interrupt and teach anybody. We allow them to run through what they would normally do. If they make mistakes or do something really interesting that could lead to a change in future policy or procedure, we debrief at the end."

Shea developed Mass Hemorrhage Protocol in collaboration with Dr. Gwen Clarke, a hematopathologist with Alberta Health Services and Clinical Professor in the Department of Laboratory Medicine and Pathology at the University of Alberta, and her colleague, Assistant Professor Amanda Van Spronsen. MLS student Megan Parrish worked on the simulation as a fourth-year project, an innovative alternative to the usual project to purify a protein or work up an assay.

The simulation has been a big hit in the field. Shea says, "The Mass Hemorrhage Protocol has turned out to be much more successful than any of us thought it would be. Once we started to offer the training to the sites, they can't get enough of it. The technologists want more and we have more than 22 sessions booked right now." Shea and colleagues are now developing the next phase of the simulation, which will include nurses, a physician and HAL, a high-fidelity simulator mannequin.

Delivering simulation on a mobile basis has its challenges, as the scenarios have to be adapted to each site's specific needs. "It's

a huge challenge to deliver simulation consistently when there are lots of inconsistencies among 44 sites. Some are so remote that they don't have certain kinds of communications in place," says Shea.

Another challenge is addressing team dynamics across different professions and making all participants feel safe about making mistakes and learning from them. "Nobody wants to look dumb, so it can often be difficult to engage everybody and not everybody likes to learn by doing hands-on. Many people would prefer to do an in-service, on their own, where they don't have to be under pressure or under the microscope being watched by their peers. We try to promote a safe, non-punitive, non-evaluative environment. That may sound easy but it's actually a very difficult thing to do," says Shea. To overcome this challenge, Shea runs a workshop to help participants understand how they can get the most from a safe-environment learning experience.

Dr. Russell sees a future trend for more team-based simulation, integration across professions and increasing scope. She says, "The future of all program work is going to be more team-based practice. Even if it's not happening in real time, it's going to be happening in asynchronous collaboration."

The future of simulation education also involves collaboration and strategic partnerships across different organizations to improve patient outcomes. "Michener was a leader in the introduction of such intensive and comprehensive simulations within applied health sciences and we continue to host visits from other institutions wishing to learn from our experience and expertise in this area," says Dr. Bridge. Michener also recently announced a partnership offer with SIM-One, a not-for-profit organization that connects the simulation community, facilities, resources and services in Ontario, to sponsor the use of CAE/CASE facilities free of charge for two days.

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Special to *CJMLS*

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