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SEPTEMBER2014

Simulation Integration

Strategies for the effective implementation of scenario-based training

An exclusive editorial supplement to *JEMS*, sponsored by Laerdal

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•introduction•

A Commitment to Simulation

Long used in the medical and aircraft industries with great success, more and more EMS agencies are realizing the benefits afforded to their systems through the integration of simulation into their education and evaluation systems.

This simulation supplement, sponsored by Laerdal Medical, is designed to give you a historical and current review of the development, use and benefits of simulation training and evaluation in EMS.

Driving forces such as the Commission on Accreditation of Allied Health Education Programs (CoAEMSP) and the *EMS Workforce Agenda for the Future* are setting clear expectations for improved patient care, improved outcomes and improved efficiency. This changing landscape has placed increased demand on EMS educators to train, certify and retrain highly competent EMTs and paramedics and evaluate their performance on a continuous basis.

Through many years of research and science, it's become well known that simulation training offers standardized, measurable learning experiences that allow students to practice and refine critical skills and procedures in risk-free environments that lead to improved competency and patient outcomes. What has been lesser known is the important role that simulation plays in EMS education, how it relates to real world practice and how it can be implemented effectively and in a cost-effective manner.

It's with these questions in mind that the National Association of EMS Educators (NAEMSE) Board of Directors made a commitment to conduct a study to characterize the use of simulation in EMS education. Upon completion of this research, the information and conclusions will be disseminated via the NAEMSE website, educational programs and professional EMS publications.

To follow the progress of this research project and locate resources based on the findings, please visit www.naemse.org.

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SIMULATION INTEGRATION: STRATEGIES FOR THE EFFECTIVE IMPLEMENTATION OF SCENARIO-BASED TRAINING is an editorial supplement sponsored by Laerdal Medical and published by PennWell Corporation, 1421 S. Sheridan Road, Tulsa, OK 74112; 918-835-3161 (ISSN 0197-2510, USPS 530-710).

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Undergraduate paramedics and new firefighter recruits simulate patient extrication at Queensland Combined Emergency Service Academy at Whyte Island in Queensland, Australia.

PHOTOS COURTESY QUEENSLAND COMBINED EMERGENCY SERVICE ACADEMY

Proven Effective

Simulation-based assessment facilitates learning & enhances clinical judgment

By Anthony Smith, M.Ed, ICP & Patrea Andersen, RN, PhD

Educational programs are designed to scaffold learning to ensure students have the knowledge, skills and attributes necessary to prepare them for the workplace. In an under-resourced healthcare environment, graduates are more often expected to require minimal orientation and practice at a level in excess of beginning competence.[1,2]

Similar to nursing and other health related qualifications, where access to clinical placements influences student preparation, paramedic education is challenged to find new ways to generate student experience, assess competence and ensure graduates meet industry requirements.

Simulation has proven to be a valuable tool for paramedic students to augment and develop skills to enhance learning. It provides an opportunity within a safe, supportive environment to practice clinical skills where individuals are able to bring their experience and knowledge into the classroom, reflect on their capability and understanding, and engage in an active intellectual learning environment.[3]

Paramedic education has traditionally used simulation and simulation-based assessment (SBA) as a means of preparing and assessing students for the prehospital work environment. This includes creating accident scenes and providing opportunities for intervention that allow students to demonstrate knowledge and skills in an often uncontrolled environment, providing unique opportunities for educators to assess student skills and competency to practice.[4]

Although simulation is identified for its contribution to learning, critics claim this doesn't portray the complexities of the actual prehospital environment and question how effective assessment is when undertaken in a controlled setting.

Issues related to the authenticity of simulation are widely acknowledged in the literature.[5,6] These have largely been addressed with developing technology and incorporating the use of actors and simulated patients in immersive teaching and assessment events.

SBA is now acknowledged as an effective strategy for teaching and learning within the healthcare industry. This article reviews the history of SBA, identifies the advantages and challenges for the use of SBA in paramedic education and discusses a debriefing process designed to enhance learning and assessment processors.

Background

There's a dearth of research in relation to paramedical education, and less on the subject of SBA.[5–9]

Due to the limited number of published papers that are EMS-specific, authors who have studied the use of SBA in paramedic education have had to access allied healthcare professional journals, especially those on medicine and nursing, for evidence-based information.[10]

To increase the professional standing of paramedic education, more research needs to be undertaken in relation to SBA.

History of Simulation

The aviation industry was one of the first to implement simulation as an educational tool to reduce the number of airline crashes attributed to human error within the cockpit. The focus and use of simulation in aviation was on developing cognitive, psychomotor and affective domains of learning and included assessment.[11–12] It was found that simulation and the use of SBA was valuable in enhancing practice competence of pilots and reducing errors.

This experience provided insights into how simulation might be successfully incorporated in other fields—including medicine, nursing, and more recently, paramedical education—to reduce patient care errors.

Advantages of SBA

Reducing patient care errors: There are certain interventions and clinical tasks healthcare personnel undertake which have the potential to adversely impact patient safety and are designated "high risk." Some of these tasks are implemented infrequently. Pediatric intubations, for example, are rare in relation to the number of pediatric patients who require this level of airway management.

Low frequency combined with the inability for clinicians to practice and maintain competency tasks such as this may become a high-risk intervention where the patient safety may be compromised. The retention of competence and ability to undertake the procedure is essential to ensure patient safety. Competence and retention of a particular skill decreases within six months, and in order for task competency to be retained, tasks need to be practiced more frequently.[6]

Simulation can address ongoing competency issues by preparing paramedics for dealing with uncommon conditions where high-risk verses low–frequency treatment of patients is an issue.[6]

Regular use of SBA has been found effective for maintaining skills for infrequently used interventions that have a high risk to patient safety and provide a means to ensure that clinicians maintain a high level of competency, make accurate clinical judgment, and thus reduce unsafe practices that impact their patients.[6]

Enhancing clinical judgment: The cornerstone of professional practice is clinical judgment. This involves thinking processes that result in the most appropriate action for a specific context/situation. In the absence of sound clinical judgment, clinical practice becomes a technical operation requiring direction from a decision maker.[13]

Improvement in clinical judgment assists in decreasing clinical error in hospital and prehospital environments. Simulation and SBA incorporate theory and practice, improve the clinical judgment of students and is a key driver for inclusion of this pedagogy in curricula. Student exposure to simulation can increase knowledge integration and assists in the formulation of clinical reasoning and decision making.[14]

This is of particular importance for student paramedics who must be vigilant, have an ability to think critically and execute accurate clinical judgment to detect life-threatening changes in patient conditions. The ability to think critically, generate alternatives, select an alternative, implement and reassess, solve problems and communicate are requirements of everyday practice. With improved clinical judgment and clinical reasoning skills, students' confidence in clinical situations should increase. As experience in clinical situations increase, so does confidence or self-efficacy.These students have a better chance at not only succeeding in their clinical goals, but they're also more likely to use and test clinical skills.[15]

To further enhance the development of clinical judgment and clinical reasoning in nursing, Tanner's Clinical Judgment Model has been used for more than three decades to assist nurses to resolve complex, ambiguous and conflicting situations.[16]

The model has four components: noticing, interpreting, responding and reflection.[16]

1) *Noticing* includes patient assessment where a nurse recognizes changes in a patient's condition and responds effectually.
2) *Interpreting* is when the nurse analyzes the patient information and prioritizes care for the patient.
3) *Responding* is the nurse's calm, confident and professional approach to the situation using effective communication. A patient care plan is implemented with skillful and well-planned judgment.
4) *Reflection* is when the nurse evaluates and analyzes the patient care plan to ensure the care was appropriate.[17]

Tanner's model is also useful in educating paramedics who work in an uncontrolled environment and at times as solo practitioner for long durations, responsible for constantly reviewing the patient, their vital signs and implementing treatment while transporting the patient to the hospital. The model has been adapted to conform to more traditional approaches and language used within paramedicine and provides a framework for facilitating the development of clinical judgment.[17]

The adapted model, referred to as the 3IR, includes four key components:

1) *Identification* of changes in the patient's condition by engaging in continual reassessment;
2) *Interpretation* of assessment finding and generation of alternatives for patient care;
3) *Implementation* of a treatment plan; and
4) *Reevaluation* of the patient and the effectiveness of treatment.

When framed around a series of questions and used in post-simulation debriefing, this model enhances student learning by providing a systematic approach to assessment, facilitates critical awareness and insight of patient needs, and assists the student to determine an appropriate treatment plan. The model also provides a framework for educators assessing student performance in SBA by providing generic criteria and performance indicators.

Facilitating Learning

In the Australasia region, the Council of Ambulance Authorities defines competence as "the consistent application of knowledge and skill to the standard as required by the industry in the workplace; it embodies the ability to adapt to new situations and environment".[18] In assessing competence, activities shouldn't be limited to reciting facts but instead should provide an opportunity for students to demonstrate deep learning and understanding. Instead of simply regurgitating information, assessment methods should be focused on evidence of achievement.[19]

Simulation provides opportunities to assess domains of learning. This includes cognitive, psychomotor and afferent attributes. For example, presenting students with a scenario where a patient requires cardiac monitoring presents an opportunity to assess the cognitive domain. The students' understanding of signs and symptoms and potential underlying pathology necessitating monitoring can be evaluated. The psychomotor function of applying electrodes to the patient in the correct location demonstrates application of knowledge and ability to perform specific skills. Student communication, professional behavior and manner highlight afferent components of practice.

SBA can assist students to develop clinical skills by providing opportunities to consolidate learning and decision making skills.[11,20]

Providing activities that are realistic with high levels of environmental fidelity enhance this by facilitating a deeper level of learning. When constructing simulation for teaching or assessment, the fidelity of practice scenarios including environmental, physical, psychological and technical fidelity should be carefully considered by educators. For paramedicine, fidelity is the extent to which the simulation can replicate the authenticity of case scenarios and the reality of the prehospital environment. Functional fidelity in simulation is considered the degree in which the simulation is "fit for purpose," that is, the level of simulation fidelity needed in order for a simulation exercise to achieve its goal.[9]

There are three levels or classifications of fidelity in learning events. These are low, medium and high fidelity.[3]

Low fidelity simulation is when learning outcomes focus on repetition and the development of psychomotor skills may employ the use of a part task trainer or manikin body part. Here the environment and context of practice may be of lesser importance to mastering a particular procedure or skill. These experiences have a ten-

Firefighter and paramedics work together to assess and treat a simulated trauma victim.

dency to be tutor lead and constructed around a practical/ laboratory type session.

Medium fidelity simulation introduces greater levels of realism and complexity, requiring students to apply a more holistic approach and introduce technically advanced manikins to replicate vital signs and allow students to undertake more complicated procedures. These experiences are more authentic and provide students with more responsibility and scope to respond to clinical situations with support.

High fidelity simulation scenarios replicate clinical environments, are immersive in nature and may involve the use of highly technically advanced manikins or standardized patients/patient actors. These simulations provide students with opportunities to engage in advanced skills, exercise clinical reasoning and take responsibility for responding to situations that replicate real-life clinical events in detail. These events often employ audiovisual technology to capture student activity and are followed by formal debriefing.

Studies show that students find the experience gained from high fidelity SBA provided clinical challenges that called for leadership and clinical decision-making responsibility they may not have the opportunity to experience in a clinical environment. Participants found these learning opportunities enhanced their critical thinking, self-confidence, problem solving and ability to integrate theory into practice.[3,20]

Debriefing is an important aspect of the learning experience in SBA. This provides an opportunity for the student to review their performance and engage in a discussion with educators. Through this engagement, students are given the opportunity to develop reflective practice skills.

These skills can be used to self-assess students' performance. In doing so, debriefing promotes clinical reflection, results in identification of clinical problems and further assists in the development of clinical reasoning and decision making. This enhances learning and provides an opportunity for error correction, promotes insight and consolidates competence.

When surveyed on the usefulness of debriefing, 95% percent of 300 survey participants stated that debriefing assisted in the identification and management of patients' problems, assisted in providing a rationale for action and for understanding reasons for treatment such as medication and fluid management. For this reason debriefing is considered a necessity in SBA.[20]

The process of debriefing will be dependent on the purpose of the aims and objectives of the simulation, and will confirm learning and direct future education needs.[19,21,22]

Ideally students should lead the discussion with the educators supporting them to critically evaluate performance. Where simulation is used for the purpose of summative assessment, the debriefing is led by the educator. This should be in accordance with the marking criteria, constructive and highlight future development and learning needs. Debriefing allows the evaluation of strengths and weaknesses, and changes can be made to appropriately address the students' needs.[22]

Challenges of SBA

While the advantages of SBA are hailed for supporting the development of confidence and competence, SBA presents challenges that need to be considered.

Student anxiety: Anxiety and fear of failure are well documented in the literature.[23] Anxiety can arise from several factors including: fear of performing in front of peers, lack of confidence in practice ability, discomfort being filmed, fear of peer retribution and exposure of weakness in debrief or lack of knowledge about the expectations of SBA. For these reasons, careful planning is required to avoid stress, and students must be supported to ensure the psychosocial environment is conducive to learning.

Educators should provide a pre-brief session designed to educate the student about how the SBA experience is structured, the learning outcomes and expectations regarding performance, marking criteria and implications if this is an assessed course component. For example, if the SBA is based around assessment of the patient and survey of an accident scene, the student must be given clear instruction regarding performance expectations.

Where students aren't given clear instruction or have no time to practice skills, performance anxiety may adversely impact the students ability to achieve. Pre-briefing as described above assists in addressing these issues.

Cost of running SBA: The financial cost in providing high–fidelity SBA can be high. This is often related to the use of technology, which includes software, hardware, manikins, patient actors and moulage. A patient simulator and related equipment can cost from $20,000–$360,000 and often requires dedicated space and trained operating staff.[5] This expense increases when conducting large mass casualty scenarios. The cost verses benefits must but considered in the learning outcomes of the student when implementing SBA.

In addition, non-monetary cost in implementing SBA needs to be considered, including:[5,6,8]

- Preparation time, including preparing for patient actors regarding the patient's condition, vital signs, medical history, medications and applying moulage.
- Staff costs/time associated with overseeing SBA, restocking and resetting the simulation scene, and assessing students.
- Purchase and preparation of equipment.

Designing low-cost, high-impact simulation can be achieved by using a group approach, thereby reducing the overall number of simulation events and using volunteer actors. For example, students are assigned to "respond to" a sudden infant death syndrome case. On arrival, a grieving mother is on the telephone to the communication center. The mother is holding a neonatal manikin, and is very emotionally withdrawn.

The level of fidelity using an actor has the potential to evoke high emotional impact on students. This triggers a need for engagement that initiates a response where the students believe they're dealing with a real-life scenario and respond accordingly.

The costs of providing a scenario like this are low. From previous experience the authors have found similar events very realistic. Debriefing indicates these types of events provide excellent triggers for assessing competence, consolidate learning and demonstrate that an important factor in SBA financial costs can be minimized.

SBA Models & Impact on Assessment

SBA uses two primary simulation models: those structured to meet the needs of assessing individuals and those structured to assess groups.

Where individual students are engaged in SBA, the number of students per cohort will dramatically affect the amount of time required and subsequently impact on the overall cost of SBA. For example, if each SBA session lasts 20 minutes and there are 250 students to assess, 83 hours would be required to complete the SBA exercise.

The alternative is to timetable students for SBA in groups. This may reduce the amount of time needed to undertake SBA and is conducive to assessing group work and communication; however, group assessment can also be problematic.

Where individual grades need to be awarded, managing the impact of performance of other students' performance on an individual's ability to achieve and how this is managed needs to be carefully considered. This is especially important when students are completing a summative assessment.

Additionally, situations where patient actors deviate from the script need to be acknowledged. Situations like this can adversely impact student performance, and educators may find themselves having to take into account behaviors and skills that don't match grading criteria. Careful preparation of patient actors is required to avoid this. Assessors' experience and understanding of the practice environment is equally essential.

Conclusion

Although there's been limited paramedical research on simulation and SBA, other health-care providers have recognized their value. It's an advantageous educational tool with the potential to influence a student's feelings, beliefs and behaviors in relation to patient care.

Although there are challenges surrounding the management of student anxiety, assessment and cost, careful preparation and planning for these issues are manageable. SBA's contribution to facilitating learning, enhancing clinical judgment and improving patient care can give our industry confidence that graduates are competent and work-ready.

Simulation is an educational tool that can be used to develop and refine clinical skills of the student in a controlled environment before they progress to becoming practicing clinicians.[24] It provides opportunities for students to practice skills frequently and, under assessment conditions, demonstrates professional paramedic competencies have been achieved and can be maintained. The main endpoint of SBA is to ensure there's a reduction in clinical errors which impact the safety of the patient. ✚

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Acknowledgement: *The authors wish to acknowledge Queensland Ambulance Service Assistant Commissioner Stephen Gough and the Queensland Combined Emergency Services Academy in assisting with the development of this article.*

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All JEMS Games activities will be held at the Baltimore Convention Center, Baltimore, MD

Cardiac Arrest to Trauma

Chicago Fire Department expands simulation training center goals

By Robert J. Fantus, BA, EMT-B; Leslee Stein-Spencer, RN, MS & Peter Lazzara, BS, EMT-P

(Above) Chicago Fire Department's tiered response is an integral part of simulation training for the new Incident Command for Cardiac Arrest program.

Since it's inception in 2009, the Chicago Fire Department's (CFD) simulation training center (STC) has provided countless hours of clinical experience and training to EMS and first responder providers throughout the city of Chicago. The STC is dedicated to a five-part mission: simulation, education, research, peer sharing and performance improvement.

Since the summer of 2012, the STC has expanded its scope beyond an advanced airway course and crew skill maintenance to include a variety of additional courses. These include:

- Incident Command for Cardiac Arrest;
- Tactical Special Weapons and Tactics (SWAT) for EMTs;
- Law Enforcement Medical and Rescue Training;
- WMD and All-Hazard Incidents; and
- An internship program.

The most expansive of these recent changes is the ICCA course, which seeks to train approximately 4,500 active members that make up the emergency responder populace in Chicago.

Incident Command for Cardiac Arrest

Across the United States, approximately 383,000 cardiac arrests occur out of the hospital. However, less than 8% of the people who suffer an out-of-hospital cardiac arrest survive.[1] Therefore, there exists a need for out-of-hospital cardiac arrest management reform in Chicago and other EMS systems.

As part of the statewide Illinois HeartRescue Project launched in August 2012, the CFD instituted an Incident Command for Cardiac Arrest (ICCA) course that emphasizes a revised team-based approach to treating sudden cardiac arrest in the prehospital setting.

The primary goal of the ICCA program is to increase the percentage of successful prehospital resuscitations in the CFD EMS System, as well as increase the number of cardiac arrest patients discharged from the hospital neurologically intact.

The new approach focuses on a code commander who's tasked with overseeing the operation of the cardiac arrest treatment and monitoring the status of all team members. This method also emphasizes the importance of early defibrillation, high-quality uninterrupted chest compressions, minimizing gaps between performing compressions and not moving the patient prematurely.

The ICCA course was developed to be taught in two stages. The first stage consists of a mandatory 70-minute didactic lecture that covers the need for the course, highlights roles and responsibilities of emergency personnel and stresses relevant cardiac arrest statistics and data.

The second stage utilizes the capabilities of the CFD STC to reinforce the primary tasks of the ICCA program. Small groups of on-duty emergency medical companies (both fire and EMS) get hands-on practice for CPR skills. These practice sessions utilize high-fidelity Laerdal simulators to give real-time feedback of compression depth, rate and accuracy. The data is displayed for the ambulance and engine crewmembers so they can assess and improve their technique with assistance from the instructors.

Simulating a Cardiac Arrest Call

Following the hands-on practice sessions, participants are placed into a 15–20 minute out-of-hospital cardiac arrest simulation specially designed to give responders a truly lifelike experience using the new ICCA approach before they're called upon to apply it in the field.

The scenario takes place in the open street area room, one of several mock rooms in the state-of-the-art STC. The class is monitored and recorded by the instructors in the control room, who watch as students treat advanced patient simulators with actual interventions they would use in the field, such as an automated external defibrillator LifePak 1000 or LifePak12 defibrillator/monitor and a quick response bag (QRB), which contains medication and critical life-saving equipment for IV/intraosseous (IO) access and airway management.

The student-driven scenario stresses the significance of high quality chest compressions, limiting time off of the chest and early defibrillation. If the correct interventions aren't performed in a timely manner, the resuscitation is unsuccessful.

The scenario starts with actual dispatch information from the instructors in the STC control room to 2–4 participants acting as an initial responding CFD first response engine company. Additional participants "arrive" as needed, increasing the manpower to a preferred CFD cardiac arrest team. These new arrivals carry out secondary code tasks such as the establishment of IV access.

Following each simulation, a non-judgmental educational debriefing is held which provides the participants with direct feedback on the quality of their team's chest compressions, ventilations and overall effectiveness. In addition, the students are able to watch a video of their team as they perform the ICCA skills and engage in an open discussion on what they did well or what they could improve on.

The CFD STC has started preliminary data collection through the SafetyPAD EMS information management system to compare cardiac

Firefighter and paramedics work together to assess and treat a simulated trauma victim.

ALS fire and ALS ambulance crews work together to assess a patient—one of the Simulation Training Center's new high-fidelity manikins.

arrest runs prior to the ICCA course with runs handled after the launch of the class. This research focuses on comparing the amount of time CFD engine companies spend on scene, proper defibrillation technique (timing and number of shocks delivered), time spent off the chest of the patient, use of their Lifepak monitor/defibrillator and the patient's ultimate outcome. The data will be compiled and presented in a future paper.

Tactical SWAT for EMTs

Tactical teams must operate flawlessly in a hostile environment. Tactical EMS members, trained EMTs with an advanced scope of practice, are integrated into the individual assault teams of the Chicago Police Department (CPD) SWAT team to provide quick self-help and buddy-help to their fellow tactical team members. To ensure training of both tactical EMS and their law enforcement counterparts, the CFD partnered with the CPD to develop a high-intensity simulation. First held in December 2012 for tactical EMS team members of the CPD and FBI SWAT teams, the special 16-hour tactical course takes place over two days and includes four hours of didactic lecture, four hours of psychomotor skill training and eight hours of simulation.

The course content covers a wide range of lifesaving interventions, including the application of hemostatic agents that control severe bleeding, such as QuikClot; the proper usage of the combat application tourniquet (CAT); starting IO infusions; and needle chest decompression.

A number of high-fidelity scenarios were designed to hone the clinical skills stressed in lecture. These scenarios take place in the CFD STC and utilize advanced patient simulators that yell, cry, sweat and bleed to enhance the realism of each simulation. Scenarios vary from a fellow SWAT member who develops chest pain during an operation to a complete, complex SWAT rescue mission that involves an active shooter. This scenario places the Chicago SWAT members in a combat situation, which requires the use of training flashbangs, actual weapons with simulated ammunition and all of the skills stressed in the lecture and hands-on/simulation training.

Law Enforcement Medical & Rescue Training

The Law Enforcement Medical and Rescue Training (LEMART) course, developed by members of the CPD, is an eight-hour course reviewing the concepts of special direct pressure bandages, application of the CAT and the use/application of QuikClot hemostatic agent. Concepts are taught through a combination of didactic lectures, hands-on skill stations and virtual reality simulation cases. The course also has a refresher on hands-only CPR that utilizes the same Laerdal advanced patient simulators and incorporates role players to serve as bystanders or other victims in the scenarios.

WMD & All-Hazard Incidents

A special hazmat-focused course, Emergency Medical Response to Weapons of Mass Destruction (WMD) and All-Hazard Incidents was created through a joint effort with the CFD and the Northeastern Illinois Public Safety Training Academy. The eight-hour course rolled out in June 2013 and focuses on biological, chemical and radiological incidents in addition to emphasizing the importance of scene awareness and scene safety.

Consisting of didactic lectures and a facilitated group discussion that reinforces the use of appropriate personal protective equipment (PPE), the concepts of proper scene size-up using the RAIN (Recognize, Avoid, Isolate and Notify) acronym, working within the incident command structure, proper performance of triage in cold and warm zones, and how to rapidly deploy and operate decontamination at incidents.

The course expands on the material through 225 minutes of simulation divided into chemical hazard, biological hazard and radiological hazard incidents. Each scenario uses a combination of video and hands-on skill practice with the STC's high-fidelity simulators.

The class begins with participants watching a first-person video segment that simulates their arrival onto a potential hazardous material scene. Then, a small group selected from the class enters into a scenario through the use of the STC's mock rooms and delivers care to high-fidelity simulators. The rest of the class watches them live from the classroom on a large video monitor.

The class synthesizes the material by applying the lessons stressed in these incidents to routine calls in order to relay the concept that scene awareness is crucial to every run. Students learn taking the extra time to step back and analyze the situation prior to responding could expose hidden threats that could be lethal to both patients and themselves.

All participants in this demanding simulation course take pre- and post-tests to gauge the retention of the training.

Internship Program

The CFD STC internship program began in May 2012. This program allows college students to gain valuable experience in EMS and prehospital care, and enables interns to work closely with CFD Medical Administration and Regulatory Compliance Division staff and become involved with high-fidelity simulators within the STC's state-of-the-art facilities. In addition, interns have the opportunity to assist with organizing and running scenarios, thereby introducing them to computer and manikin simulation programs.

Interns learn how to write scenarios for the patient simulators utilizing scenario-writing software and help apply moulage to human and manikin simulators with a large array of makeup and accessories to create realistic looking injuries.

They're also given the opportunity to go on ride alongs with CFD ambulance crews to get first-hand experience in the prehospital atmosphere and have the option to work on CFD STC research projects. This program provides a unique source of clinical and research experience for those interested in a career in the medical field.

Law enforcement personnel apply a tourniquet to an injured simulated officer part of Law Enforcement Medical and Rescue Training.

Conclusion

The CFD operates a modern, robust simulation training center and offers courses deemed critical to highly demanding field operations. Simulation participants have found each program to be an important educational experience designed to assist them in the performance of their duties and, most importantly, keep them safe while doing so. Several of the simulation programs cross agency boundaries and enable all involved team members to work together in a cooperative and coordinated manner. ✚

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Simulated MCI Training

Simulation training for MCIs helps students form a variety of patterns and optimizes their triage performance.

PHOTOS COURTESY PRINCE SULTAN BIN ABDULAZIZ COLLEGE FOR EMS

Paramedic students practice triage & patient care in the Kingdom of Saudi Arabia

By William Leggio, EdD, MS NDR, BS EMS, NREMT-P; Michael Krtek, BS, NREMT-P; Ahed Najjar, MS IPH, BSN, AREMT-FP; Hashim Binsalleeh, MD; Deifallah Alrazeeni, Phd & Khalid Fouda Neel, MD

Simulation training in EMS education is well-known as a learning method that allows students to demonstrate their ability to perform patient assessments and interventions in a safe manner. It's also well known that EMS providers serve as first responders not only to emergencies with a single patient, but also respond to mass casualty incidents (MCI) where multiple patients require triage.

The MCI triage process requires rapid and accurate decision making.[1] Limited data has been collected concerning the ability of EMS to triage patients during MCIs.[2] A known challenge to the formal MCI triage process is that personal judgment can affect the decision-making process, and this can succeed triage instruments.[3]

Though personal judgment could have such an effect on an EMS provider's ability to triage during an MCI, one study found paramedics were better able to triage when combining both a triage scale and personal judgment when compared to the application of one without the other.[3]

Another study evaluating 109 EMS providers on their ability to triage during an MCI concluded the ability of EMS providers of all training levels and experience was less than optimal.[2]

Researchers have assessed the potential benefits of simulated MCI training scenarios and results suggest simulated MCIs:

- Helped students form a variety of patterns and optimized their triage performance;[3]
- Improved triage, intervention scores, speed and self-efficacy by novice learners during a multi-manikin MCI training experience;[1] and
- Improved abilities following a single didactic session on MCI patient triage that persisted one month later.[2]

Therefore, support for simulated MCI training is present in the literature and the scenarios reflect the challenges faced during an actual triage.

EMS (MCI) Olympics

In May 2013, Prince Sultan bin Abdul Aziz College for EMS (PSCEMS) of King Saud University in Riyadh, Kingdom of Saudi Arabia, held its first EMS Olympics, a day designed for students to showcase their research projects, but most importantly, to participate in simulated MCI training exercises.

Forty-two students formed six teams of seven students and competed against each other. The students who competed had already completed EMT training as well as training at the paramedic level in the management of pulmonary, cardiology, medical and trauma emergencies. The aim of the training was to have students triage, demonstrate EMS skills and their ability to both communicate and work together during MCI scenarios.

The Scenario

The MCI training at PSCEMS was held on a floor with three ambulance simulators and open spaces. (See Figure1.) The simulated theme of the MCI was an explosion in an office building. The MCI involved eight patients: a rescue manikin, two high-fidelity manikins and five students acting as patients.

Each team had 15 minutes to respond and manage the MCI. Time was announced over a speaker system throughout the scenario. The speaker system also played a recorded audio of traffic sounds, muffled radio transmissions, first responder sirens, and sounds of aircraft and helicopters flying overhead.

After receiving dispatch information, the teams would respond and were required to enter the scene by climbing up a set of stairs. This prevented the teams from seeing the scene before entering. Upon entering the scene, teams were able to find six of the eight patients.

Patient 1 was an apneic and pulseless rescue manikin who suffered second and third degree burns to his upper body and face.

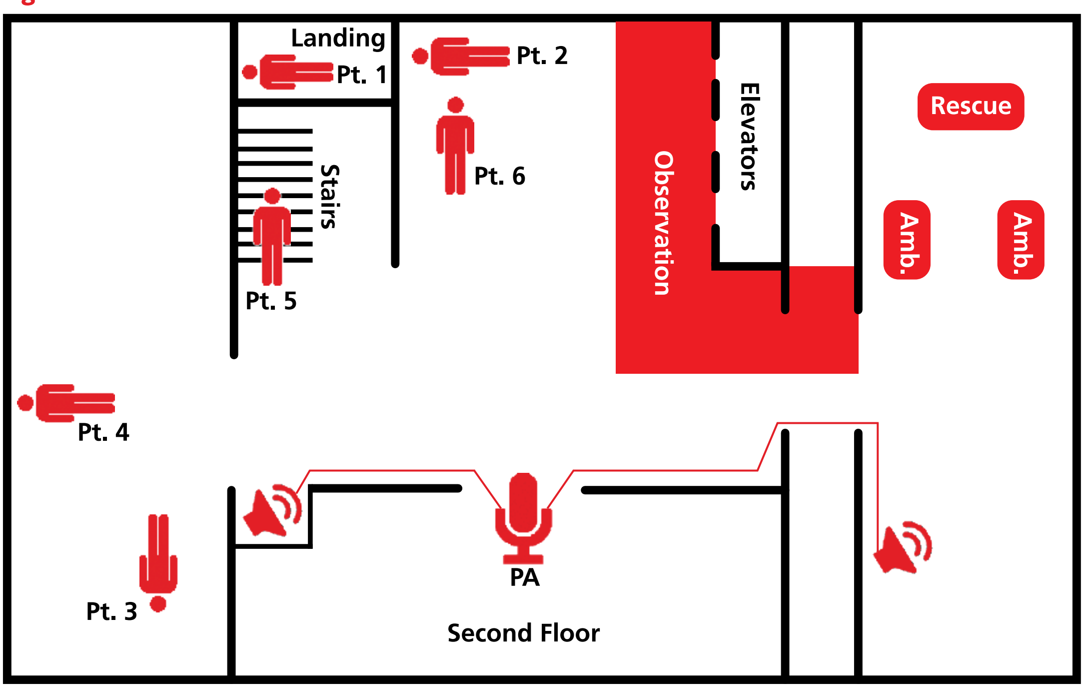
Patients 2 and 3 were programmed high-fidelity manikins. Patient 2 was an unresponsive male with a closed head injury and increasing intracranial pressure who went into cardiac arrest after seven minutes.

Patient 3 presented as semi-responsive and suffering from an eviscerated abdomen and programmed to become unresponsive at five minutes and continue to progress into irreversible shock.

Patients 4, 5 and 6 were student actors. Patient 4 presented on the floor with an open femur fracture. Patient 5 had burns to both hands and patient 6 was emotional and suffering from a closed head injury. Patients 5 and 6 were also instructed to demand that EMS responders help their friends. These two patients were also instructed to follow commands, but told that if left alone in a treatment area, they should reenter the scene and continue demanding help and assistance.

Patient 7 entered the scene by coming down the stairs after three minutes into the scenario. This patient was confused and suffering from a closed head injury.

Figure 1.



Patient 8 entered the scene by coming down the stairs after six minutes. Patient 8 was a friend of patient 4 and was instructed to go to his friend. Once at his friend's side, and after seeing his friend's open femur fracture, patient 8 would faint, fall to the ground and become unresponsive.

Teams, Equipment & Scoring

Students formed their own teams and selected a team leader. Before the first scenario, all the teams met together with the event organizer to receive instructions and confirmed the order in which teams would perform. Before each scenario, teams were given triage tags, five portable radios and instructed to stand by.

Teams were able to carry basic equipment and response bags, but were required to go to the ambulance simulators to gather their stretchers and additional equipment. Two of the ambulance simulators were designated as transporting ambulances and the third was designated as a quick response vehicle that had extra supplies.

A mixture of PSCEMS faculty, local EMS providers and program stakeholders evaluated team performances. Each patient had an assigned evaluator who scored how each patient was triaged and treated. In addition, the team leader, overall team performance and MCI scene management were evaluated.

Two evaluators had portable radios and served as a dispatcher and medical director or receiving ED. Teams were assessed on their communications with dispatch, medical direction and receiving EDs.

Use of Patient Actors, Moulage & Manikins

EMS students who had completed EMT training were asked to volunteer to be patients. Each patient was provided scripted answers to standard assessment questions and instructed to react the same way with each team. Moulage was applied to each actor to create lifelike injuries.

At the conclusion of each scenario, each moulaged injury was inspected and, if needed, reapplied or refreshed to maintain consistency of appearance throughout the training. Manikins were only moulaged with premade products.

The use of the high-fidelity manikins in the MCI scenario were considered to be an element of the scenario that was standardized for all teams. These dynamic patients were programmed to evolve because of scenario time and not treatment rendered or team performance.

Research Findings

Nine EMS students who volunteered to compete in the scenario met with William Leggio, EdD, MS NDR, BS EMS, NREMT-P, or Michael Krtek, BS, NREMT-P, to answer questions regarding the MCI training. Interview questions focused on team preparation, overall experi-

Each patient had an assigned evaluator who scored how each patient was triaged and treated.

Ambulance simulators were designated as transporting ambulances.

ence, personal experience and recommendations for future MCI trainings.

Each interview was recorded and transcribed. Both interviewers reviewed transcripts for possible errors made during transcription. Each participant received their transcript and was asked to review them for possible transcription errors. Transcripts were manually analyzed to identify themes then again using NVivo 10 qualitative research software.

Data and Analysis

In general, participants described the MCI scenario as a great, fun and well-organized experience. The participants recognized the purpose of the MCI scenario and discussed the challenges they faced. They provided feedback by discussing strengths and weaknesses of the training. Four general focus areas that surfaced after data analysis were:

1. Preparation;
2. Good and bad scene elements;
3. Lessons learned; and
4. Future recommendations.

1 **Preparation:** Participants described field and clinical experiences as one source of being prepared for the MCI scenario. Their field and clinical experiences developed self-confidence in their ability to be a responder and provided experience of approaching actual scenes. The EMT and BLS courses students had completed were also felt to be an additional source of preparation.

Participants felt their EMT training prepared them for the MCI scenario because most patients required more basic interventions and assessment than advanced.

Participants also described the application of interventional skills and patient assessment techniques learned in trauma, medical, cardiology and pulmonary emergency courses as sources of preparation.

Participants stated that they had learned the basics of triage in both EMT and trauma emergencies, but described a need to look for additional sources on the Internet days before the MCI scenario.

2 **Good & Bad Scene Elements:** Many participants described the use of moulaged patient actors as a strength of the scenario because the patients could answer questions, move freely and made the scenario seem more real. The scene noise playing during the MCI was also described as a strength. One participant felt that the audio created a noisy and rowdy scene.

Participants also felt the use of the high-fidelity manikins was a strength of the scenario. One participant said he wasn't focused on the manikin being real or not but simply, "just doing my job and finishing."

Allowing observers to be too close to the scenario was described as one weakness of the MCI scenario. Participants described that observers were heard making comments and tried distracting other teams. The proximity of the ob-

Moulage was applied to each patient actor to create lifelike injuries.

servers was attributed to the scene layout. The construction of the space available provided limitations of laying out the scene in terms of space for the scenario, observation area and participant entrance.

Participants found it difficult responding with minimal equipment and having to retrieve the rest of their equipment from the ambulance simulators. However, this presented a realistic scenario where equipment had to be retrieved from a vehicle parked outside and away from the incident.

3 **Lessons Learned:** This MCI scenario provided the participants with an opportunity to learn from their mistakes. After completing this MCI scenario, participants described a boost in their confidence to respond and perform at an actual MCI scene. In addition, they all learned the critical aspect of being able to communicate with team members and the importance of organizing their team by defined roles and responsibilities.

Participants also described learning the importance of time management in providing patient care, being able to manage more than one patient and how to remain open-minded even when prepared for an MCI.

In addition, learning the importance of trusting their team, being a professional and not placing blame on just one team member were described by participants as additional lessons learned. Participants reinforced the learning experience of being part of this simulated MCI scenario and appreciated the value it added to their education.

4 **Future Recommendations:** Participants identified the need for more triage education and practice before participating in an MCI scenario. They felt that one or two lectures on how to triage and answering examination questions were not enough. Participants identified the need for additional lectures and triage simulation labs.

In addition to simulated triage labs, participants also discussed the need for EMS operation lab sessions that are focused on communicating with a radio, strategic and efficient use of ambulance stretchers and creating treatment zones. Participants embraced the use of both patient actors and manikins. Some participants described the added value of patient actors and encouraged that future scenarios have more patient actors. However, some participants noted the limitations of patient actors such as their inability to control their heart rate or blood pressure which the high-fidelity manikins can do.

The need for outdoor MCI exercises was also discussed by participants because EMS is a profession that's often called upon to work major incidents outdoors, particularly in Saudi Arabia where the environment presents challenges such as desert heat. In addition, participants felt that it would be beneficial to incorporate medical patients or have a medical-themed MCI exercise.

Discussion & Recommendations

This study supported the use of MCI training scenarios that evolve and are dynamic. The data collected in this study supported findings in the research discussed. Participants reported feeling more confident in their ability to perform triage during an actual MCI after participating in this simulated MCI training.

Likewise, participants described the benefits of using both high-fidelity manikins as well as patient actors during an MCI. The data supported the need for both medical and trauma patients, and though not discussed in the data, the authors recommend the use of pediatric patients as MCIs potentially involve both adults and children.

This training exercise allowed students to perform under pressure, reflect on mistakes and learn in a way that was challenging and fun. In an educational sense, this exercise identified areas for improvement in EMS student education and training.

Developing skills, identifying areas of weakness in education and building confidence ought not to be limited to EMS education. The authors recommend:

1. The use of simulated MCI training for EMS education and emergency responder training;
2. That organizers of MCI scenarios consider the use of audio and both patient actors and manikins in their scenarios;
3. MCI scenarios be conducted in areas conducive to realistic scene creation and the separation of observers from the scenario;
4. Careful consideration should be given to the challenges that outdoor MCI scenarios create for responders, their equipment and the high-fidelity manikins in an extreme environment.

Conclusion

MCI training scenarios hold the potential for a wealth of learning, reflection and professional development, and should become a stronger part of EMS education and provider development. The response from our students, who recognized significant learning benefit from this training, illustrated the value of this training. The role of MCI scenario training in the EMS program at PSCEMS will be increased because of this experience.

MCI scenario training exercises provide an opportunity for students to perform in teams. This, with the opportunity for interdisciplinary training with other first responders and emergency health professions, ought to be embraced.

The authors strongly encourage EMS researchers to continue exploring MCI training scenarios. This study identified a need to research the effectiveness or limitations of patient actors, high-fidelity manikins and MCI training scenarios in general. It also identified the need to research the effectiveness of outdoor MCI training versus indoor. Lastly, the authors advocate for further research on the challenges faced by EMS education and training agencies in being able to conduct MCI training scenarios. ✚

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Acknowledgement: *The authors acknowledge Prince Sultan bin Abdulaziz College for EMS and King Saud University, Riyadh, Kingdom of Saudi Arabia, for the encouragement and support needed to develop the EMS Olympics MCI training and this article.*

William Leggio, EdD, MS NDR, BS EMS, NREMT-P, personally acknowledges and expresses appreciation of Chief Rodney Turpel of North Lauderdale Fire and Rescue Department, North Lauderdale, Fla., and former EMS Chief at Nebraska City Fire and Rescue, Nebraska City, Neb., for sharing his many years of experience in creating simulated+ MCI training scenarios.

Photos for this article were taken by PSCEMS students Rasheed Hani Mukhtar, Abdullah Mohammed Al Jamaan, Badran AlJardan and Talal Abusuliman, along with Quality and Accreditation Coordinator Shazad Khan.

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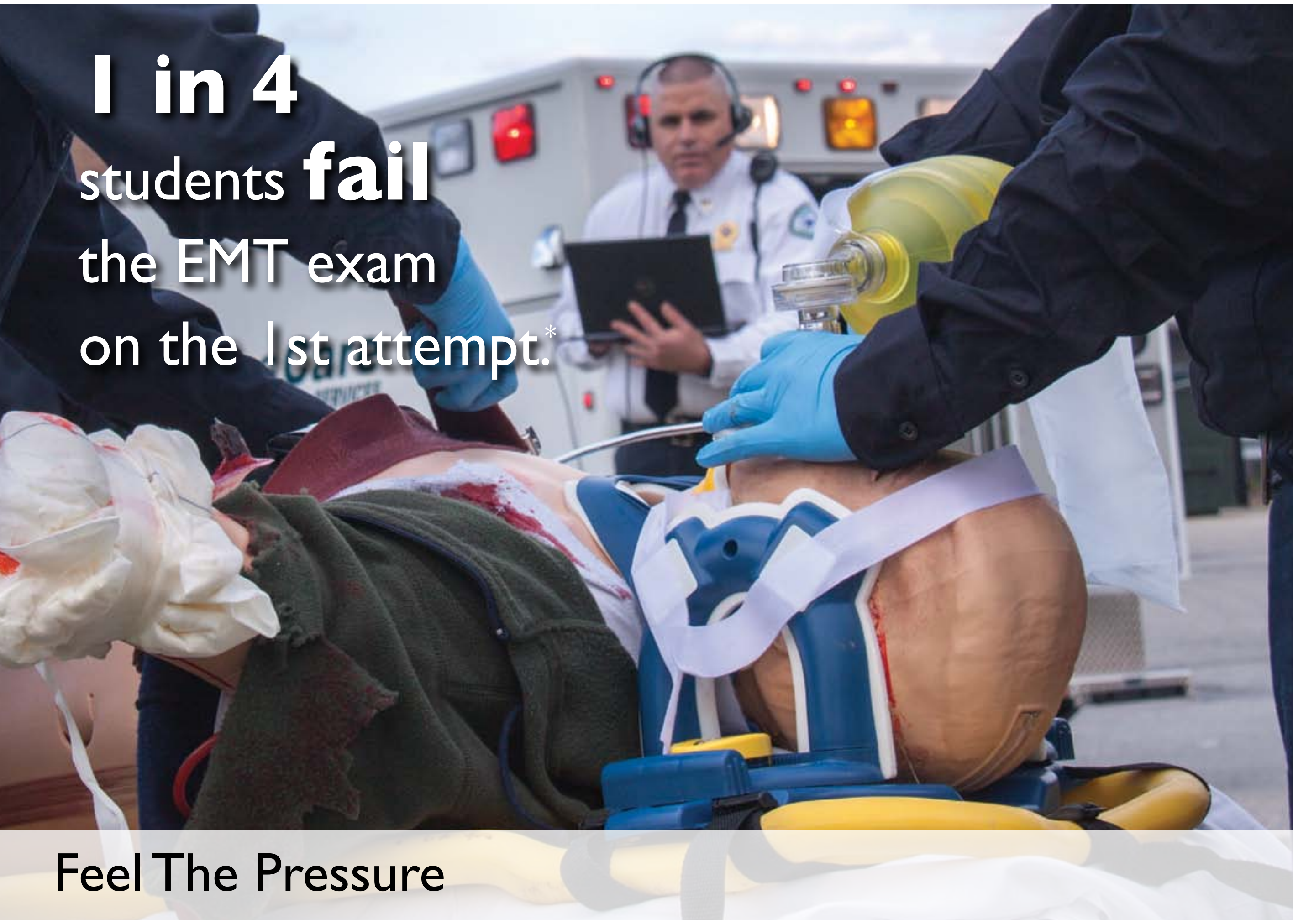

In 2012, the national average first-time pass rate of the EMT exam was 72%. Across the country, pass rates varied from 59% to 84% suggesting the need for instructional consistency in every state. Simulation can help achieve quality education through standardized learning, and ultimately improve pass rates.

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