ORIGINAL ARTICLE

High-fidelity multiactor emergency preparedness training for patient care providers

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Abstract

Background: *Providing comprehensive emergency preparedness training (EPT) for patient care providers is important to the future success of emergency preparedness operations in the United States. Disasters are rare, complex events involving many patients and environmental factors that are difficult to reproduce in a training environment. Few EPT programs possess both competency-driven goals and metrics to measure life-saving performance during a multiactor simulated disaster.*

Methods: *The development of an EPT curriculum for patient care providers—provided first to medical students, then to a group of experienced disaster medical providers—that recreates a simulated clinical disaster using a combination of up to 15 live actors and six high-fidelity human simulators is described. Specifically, the authors detail the Center for Health Professional Training and Emergency Response's (CHPTER's) 1-day clinical EPT course including its organization, core competency development, medical student self-evaluation, and course assessment.*

Results: *Two 1-day courses hosted by CHPTER were conducted in a university simulation center. Students who completed the course improved their overall knowledge and comfort level with EPT skills.*

Conclusions: *The authors believe this is the first published description of a curriculum method that combines high-fidelity, multiactor scenarios to measure the life-saving performance of patient care providers utilizing a clinical disaster scenario with >10 patients at once. A larger scale study, or preferably a multicenter trial, is needed to further study the impact of this curriculum and its potential to protect provider and patient lives.*

Key words: high-fidelity simulation, simulator, simulation, performance, performance-based, emergency preparedness, disaster medicine, disaster training, training, medical trainee, medical student, health professional, healthcare worker, first responder, emergency medical services, first receiver

Introduction

The lack of emergency preparedness training (EPT) for patient care providers—including clinicians, hospital workers, mental health providers, public safety and law enforcement officials, community volunteers, emergency medical system (EMS), hazardous materials (HazMat), and fire personnel—poses significant risks to both patients and patient care providers. During the 1995 Tokyo sarin gas attacks, for example, up to 80 percent of patients bypassed first responders and reported directly to hospitals where hospital staff suffered secondary exposure to sarin due to inadequate personal protective equipment (PPE) and training.[1] Furthermore, during Hurricane Katrina, the lack of EPT was cited as a significant factor contributing to adverse patient outcomes.[2-7]

Providing comprehensive EPT for medical trainees—including medical, nursing, and other healthcare trainees—is important to the future success of emergency preparedness operations in the United States.[8-15] Just weeks before the 9/11 terrorist

DOI:10.5055/ajdm.2012.0093

attacks, an American College of Emergency Physicians (ACEP) task force published recommendations for medical students to develop skill-based EPT competencies for nuclear, biological, and chemical incidents.[16] Immediately after 9/11, a report by the Association of American Medical Colleges (AAMC)—and later by the Institute of Medicine (IOM)—encouraged early introduction of bioterrorism topics in medical schools.[17,18] Unfortunately, US medical schools have been slow to develop stand-alone EPT curricula.[17,19] Few medical schools have defined and implemented EPT core competencies for health professionals,[19,20] and newly developed EPT programs have largely focused on practicing clinicians and not trainees.[21-24]

Disasters are rare, complex events involving many patients and environmental factors that are difficult to reproduce inside a classroom. Recent reviews suggest that healthcare worker EPT programs lack clarity, objectivity, competency-driven goals, scientific rigor, prospective validation, and consistency across medical specialties.[25-28]

In a prior study, we revealed how medical students can value and rapidly learn some core EPT elements via a novel addition to a medical school's curriculum.[19,29] Students who completed our 3-hour "Disaster 101" curriculum vastly increased their overall knowledge and comfort level with EPT skills. A significant limitation of our study was the relatively simplistic measurement of EPT performance. In one scenario, students were required to rapidly triage 100 life-sized inflatable mannequins tagged with physical parameters indicating respiratory, circulatory, and mental status. It was suggested from the curriculum review that the validity and reliability of the EPT performance measurement would be better suited in a controlled environment, such as the university human patient simulation laboratory, in which a combination of live actors and human-simulated patients could reproduce the "chaos" associated with a clinical disaster. It was further suggested that high-fidelity patient simulators could help us evaluate the impact of our EPT on patient outcomes, for example, whether trainees could appropriately triage and intervene medically to save a life.

Here, we described the development of a human simulation-based EPT curriculum for patient care providers that recreates a chaotic clinical disaster through a combination of up to 15 live actors and six high-fidelity human simulators. Specifically, we detail the Center for Health Professional Training and Emergency Response's (CHPTER's) 1-day clinical EPT course—provided first to medical students, then to a group of experienced disaster medical providers—including its organization, core competency and content development, medical student self-evaluation and course assessment. To our knowledge, this is the first published description of a curriculum method that combines high-fidelity, multiactor scenarios to measure the life-saving performance of patient care providers utilizing a clinical disaster scenario with >10 patients at once.

Curriculum development—organization

In 2009, CHPTER was formed as South Carolina's first collaborative EPT center for health professionals (*www.musc.edu/chpter*). A community-wide advisory committee of emergency preparedness stakeholders—including regional hospitals, NGO's, public health officials, EMS, and law enforcement agencies—met to establish goals for CHPTER to enhance regional health security. CHPTER established a mission to enhance regional health security and surge capability by giving patient care providers hands-on lessons that will protect and save patient lives during a disaster.

A curriculum task force of the CHPTER Advisory Committee consisting of health professional and emergency preparedness experts met and decided the following: 1) the EPT course should not be more than 1 day to ensure increased attendance from busy trainees and other patient care providers; 2) the curriculum should be directed toward the general medical trainee, defined broadly as any patient care provider during a disaster, so it could develop into an interdisciplinary experience; 3) the curriculum should be interactive and case-based so trainees could recognize the relevance of disaster medicine knowledge and clinical skills to their work place; 4) human simulation and multipatient encounters should be used to create realistic clinical disasters; and 5) research metrics should be developed to measure trainee skill acquisition and performance to save lives during a disaster. The task force hypothesized that the newly proposed EPT course would improve patient care provider knowledge, skills, and comfort level necessary to save lives during a disaster. The task force evaluated existing competency objectives and domains from a course given to fourth year university medical students in 2008 and 2009.[19,29] Additional competency and evaluative frameworks considered included those from the Veteran's Health Administration (VHA), the American Medical Association's Center for Public Health Preparedness and Disaster Response, the Agency for Health Care Research and Quality (AHRQ), Columbia University, and others.[30-35]

Curriculum development

Over the course of several months, the task force worked to establish learning objectives for CHPTER trainees (Table 1a). Of the nine learning objectives, we categorized six as "discrete knowledge/cognitive," three as "performance/skill" and two as "attitudinal/affective," according to Bloom's Taxonomy.[36-38] Through a modified Delphi process, the task force developed competencies for the course. Dozens of competencies were consolidated into 18 and were subsequently assigned to five competency domains: mobilization, operations/communications, human safety and facility continuity, demobilization, and awareness (Table 1b). The task force then developed performance measures to match competency/learning objectives and used these to guide content development for the didactic, small group and simulation components of the course. A course itinerary was developed to accommodate the 1-day schedule limit (Table 2).

Small group exercise scenario development

Small group exercises were developed for the communication, teamwork, and triage modules. Exercises were designed to prepare students for the afternoon simulation exercise and included interactive training experiences that were administered by trained CHPTER facilitators and core faculty. During the "teamwork" small group exercise, teams of four to five trainees were confronted with an image about a disaster scene disguised as a 34 piece puzzle inside an envelope. Four envelopes containing a unique fictional disaster scenario (scenario 1, dirty bomb; scenario 2, concert blast; scenario 3, earthquake; and scenario 4, flu-like illness) were presented to trainees in series. Teams were instructed that they were to complete at least one puzzle using skills that they learned during the didactic session. Facilitators timed and rated team performance and recorded team feedback about the exercise.

The "communications" small group exercise consisted of three scenarios (scenario 1, bus crash; scenario 2, factory explosion; and scenario 3, chemical leak) presented to team members on preprinted handouts. Scenarios were discussed in small group with the help of the facilitator who measured the extent to which the group could effectively communicate clinical disaster information. During the "triage" small group exercise, teams were asked to sort hundreds of small toys with preprinted medical information printed on them according to the START triage system. Instructors evaluated trainees based on their ability to work as a team to rapidly assess and accurately triage several patients at once.

Human simulation and actor scenario development

The task force addressed the Advisory Committee goal regarding the development of performance metrics for a clinical disaster scenario by partnering with the university's Clinical Effectiveness and Patient Safety Center. The center boasts a $2M, 3,300 m² patient simulator facility, in-house training engineering staff, computer and software experts, and a wide range of research tools including discrete viewing rooms, digital video, and software simulation technologies.

Human simulators (SimMan™) in the center have the ability to demonstrate physical exam findings (ie, pulse, breathing rate, ocular reflexes, and remote-triggered verbal statements) and to respond to caregiver procedures (ie, jaw thrust, bag valve mask, tourniquets, blood pressure measurement, chest tubes, and intravenous/intraosseous medicines). The staff has the ability to program individual patient mannequins to follow variable physiologic "curves" and to observe trainee performance via one-way observation rooms (see Figure 1). Some mannequins may be preprogrammed to enter ventricular fibrillation or cardiopulmonary arrest if the

Table 1. Course learning objectives, course competency domains, and performance objective categories

Learning objectives

A. Define a healthcare disaster and the components of emergency preparedness as it applies to patient providers.*

B. Understand ethical implications of a healthcare disaster and its impact on the community.†

C. Differentiate between National Incident Management System (NIMS), Incident Command System (ICS/HICS) and the operational disaster/emergency preparedness plan for a healthcare facility.*

D. Identify functional roles (and appreciate your individual limits) of patient care providers during a disaster.*,†

E. Define and demonstrate ability to function within the chain of command during a patient care disaster scene.*,‡

F. Define and respond to vulnerabilities and security risks facing providers, healthcare workers, and healthcare facilities during a disaster scenario.*,‡

G. Summarize components of teamwork, communication, and triage that are essential to an effective response during a healthcare disaster and list specific actions to take and to avoid during a healthcare disaster.*

H. Demonstrate effective teamwork, communication, and triage to protect patient care providers and save lives during a disaster scenario.‡

I. Achieve a greater comfort level with knowledge and skill to provide effective patient care during a clinical disaster.†

Competency domains and performance objective categories

Mobilization: prestage planning and team development

- Define and recognize a disaster [A and F]
- Stop: establish a safety plan [D and F-H]
- Develop clinical disaster team (ie, establish leadership, roles and duties) [D and F-H]
- Select and don appropriate PPE and supplies [F-H]

Clinical disaster operations and communications

- Establish operations command (ie, assume team roles) [C-E and H]
- Establish communications with healthcare authority and activate Healthcare Incident Command System (HICS) [C-E and H]
- Appropriately report scene information and needs (ie, maintain situational awareness) [C-E and H]
- Optimize teamwork and coordinate tasks [C-E and H]

Protect and preserve human life and continuity of healthcare facility during a disaster

- Ensure personal safety [C-H]
- Ensure safety of patients, families, and staff [D-H]
- Accurately assess, reassess, and care for patients [D-H]
- Ensure continuity of patient care operations [D-H]
- Preserve integrity and conservation of the physical plant [D-H]
- Perform maneuvers to save simulated patients during a disaster scenario [F and H]

Demobilization

- Ensure effective demobilization of healthcare resources [A, C, F, and G]
- *Clinical disaster and emergency preparedness awareness*
- Understand role of provider to support patients and the community [B and D]
- Understand ethical implications of patient care during a disaster [B and H]
- Self-assess capabilities and limits as a provider during a disaster [B and D]

*Discrete knowledge/cognitive objective.
†Attitudinal/affective objective.
‡Performance/skill objective.

airway is not opened and secured in a timely fashion. Other mannequins can be programmed to follow more normal physiologic curves with normal vital signs but have stark physical exam findings (ie, an open shoulder fracture).

Over 6 months, CHPTER worked with center engineers to develop a series of fictional clinical disasters that combined up to six patient simulators and up to 15 trained "actors" to simulate a moderately sized clinical disaster. We designed one of the center's larger observation rooms to look like a small emergency waiting room with several chairs, a security guard's desk, a metal detector, and communication devices. There was also a door outside the simulation center that was used to simulate an emergency department (ED) entrance. Not unlike the development of a short film, storyboards

Table 2. CHPTER course schedule	
Hour	**Event**
7:45-8 AM	Pretest and consent Welcome Online material (prior to arrival) Pretest and self-evaluation Online learning material
On arrival	*Pretest (if not already complete)* *Consent forms* *Sign in sheet*
8-8:55 AM	Module 1: the CHPTER (50 minutes)
What is at risk? Clinical disaster preparedness: healthcare training gap The CHPTER model: a regional disaster response training network What to expect? Schedule Sim scenario expectations If you learn nothing else: BE SAFE Ensure personal safety, safety of patients, families, and staff follow-up Ensure continuity of patient care operations	
9-9:45 AM	Module 2: mobilization: prestage planning and clinical teamwork (25-minute slides, 20-minute small group)
Define and recognize disaster Stop: establish safety plan Develop clinical disaster team (ie, establish leadership, roles, and duties) Select and don appropriate PPE Optimize teamwork and coordinate tasks Module 2 small group exercise (teamwork exercise)	
15-Minute break/time buffer	
10-10:45 AM	Module 3: clinical disaster scene operations and communications (25-minute slides, 20-minute small group)
Understand importance and principles of hospital incident command (HICS) Establish operations command (ie, assume team roles) Establish communications with healthcare authority; activate healthcare system's EOP/ICS Appropriately report scene information and needs (ie, maintain situational awareness) Optimize teamwork and coordinate tasks Module 3 small group exercise (communications)	
15-Minute break/time buffer	
11-11:45 AM	Module 4: protect and preserve human life (25-minute slides, 20-minute small group)
Accurately assess, reassess, and care for patients (START triage) Care for and communicate with the worried well Understand ethical implications of healthcare during a disaster (values foster by triage) Module 4 small group exercise (triage)	
12-1 PM lunch	
1-4 PM	Multiactor simulated disaster CHPTER's scenario: influenza-like illness Education intervention: debriefing Repeat scenario
4-5 PM	Post-test and course assessment
	After completion of mass casualty scenario *Post-test (online)* *Course evaluation (online)*
	4-6 months after course *Repeat post-test and self-evaluation*

Figure 1. EPT facilitators observing trainees during EPT multiactor disaster scenario.

and a stage map were developed for the simulated exercise (Figure 2).

CHPTER facilitators and core faculty were trained by the simulation center to operate simulation center equipment and software. Facilitators were assigned to different geographical zones (#1-3) of the scene so that they could more easily focus on performance objectives during the chaotic movement of patients and actors during the scenario.

Two months before training, we gathered up to 15 actors—including trained patient actors from the medical university—and provided them pre-scripted roles. To enhance reliability and validity of the expected performance objectives from trainees, actors were taught how to follow specific behaviors when confronted with trainees in a chaotic environment. For example, one actor (patient 3A2) was asked to complain very loudly about his symptoms. If he was not counseled by a trainee, or redirected, he would create a disturbance and interfere with the care of some of the mannequins. If he received any counseling from a trainee, he would simply sit down or follow directions.

Multiactor clinical disaster scenario: "influenza-like illness"

The clinical casualty scenario developed by the curriculum task force involved the acute presentation of cruise line tourists complaining of cough and shortness of

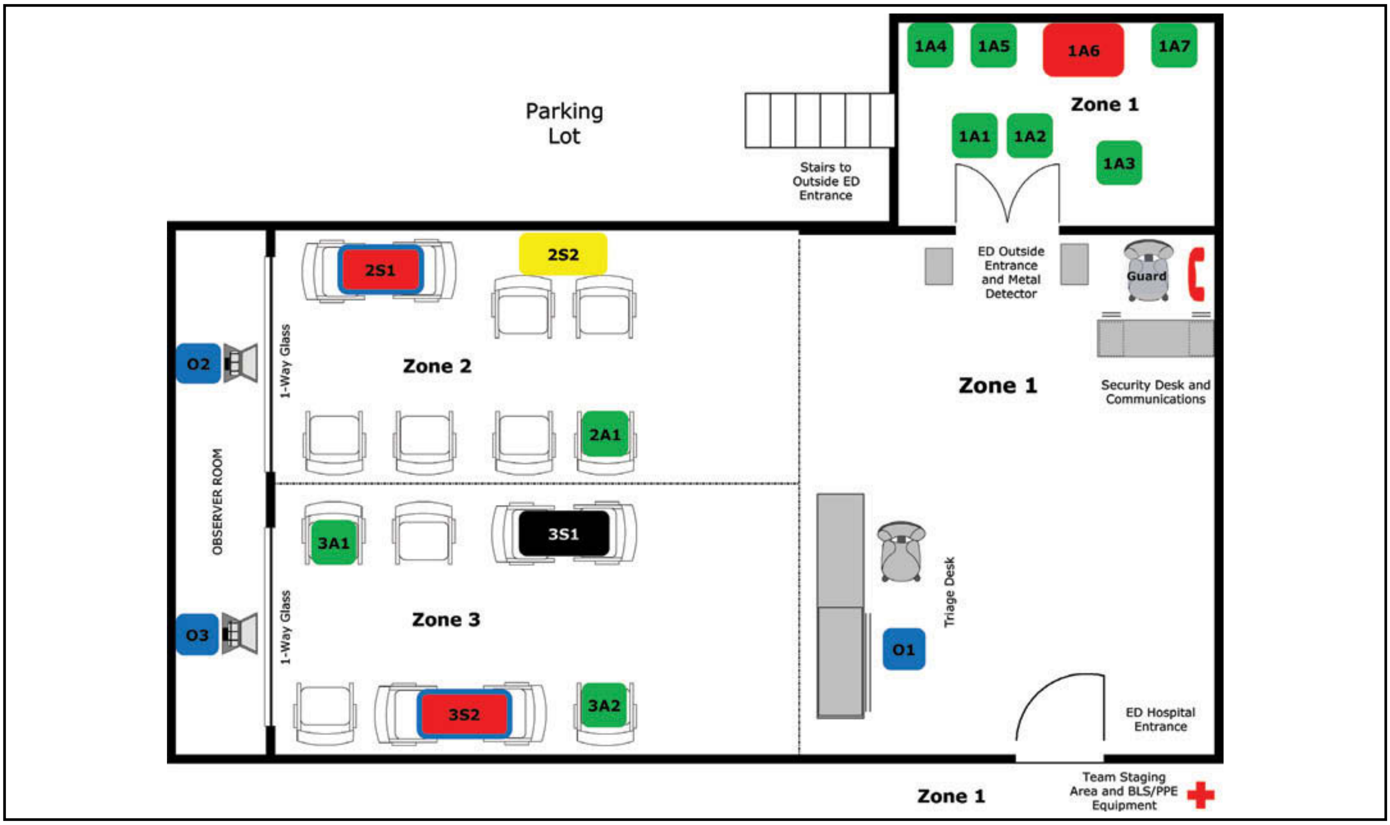

Figure 2. High-fidelity simulator and actor staging in simulation lab. Blue: observer trainer; green: triage green; yellow: triage yellow; red: triage red; black: triage black; A, actor; S, high-fidelity human simulator; 1, zone 1; 2, zone 2; and 3, zone 3. Example: 2S1 (red) is a high-fidelity human simulator patient who is triage red in zone 2.

breath. During the six-minute scenario (influenza-like illness), both actors and simulators experience various levels of respiratory complaints, several of them waiting to access the ED waiting room. Working in teams of four to six, trainees were required to mitigate the complex scene using skills they learned during didactic and small group lessons. The responders were not aware that some patients were suffering from inhalation anthrax. They are also unaware that one of the patients waiting to access the ED was carrying two bags of powder, presumed to be anthrax.

Of the four human simulators used in this scenario, two were unstable and required active airway maneuvers (ie, a simple jaw thrust) to open their airway. If teams recognized the acuity of the patients and acted before 4 minutes, the simulator's vital signs normalized. If not, CHPTER facilitators allowed the physiologic parameters of the simulators to deteriorate irreversibly to cardiac arrest.

Trainees were also confronted with several actors demanding care. The actors were trained to escalate their behavior during the scenario, unless appropriate performance measures were met. Once escorted to the green triage waiting area, minor patients changed costumes and presented to the ED entrance as new patients. One actor (the terrorist disguised as a tourist) uses a distraction caused by other actors to bypass security and enter the ED waiting room. If teams close the ED door before 4 minutes, the terrorist threat is averted. If they do not do this, the actor enters the ED and holds up two bags of powder, exposing all patients and all providers to a simulated lethal dose.

An educational intervention was developed for all teams participating in the mass casualty scenario. Immediately after teams completed their first 6-minute scenario, trainees were escorted to a debriefing room. Using a digital split screen, teams were presented with a playback of their performance using up to four different camera viewpoints. CHPTER instructors were trained to reinforce key components of the learning objectives and competencies for the course without providing specifics to remedy the disaster scene. Per study design, teams were permitted to repeat the 6-minute scenario after the debriefing. Team membership and scenario content did not change.

Planning, logistics, and recruitment

Running concurrent with the curriculum development process were multiple planning operations. Over a 2-year period, CHPTER Advisory Committee members worked to brief and receive input from hospital and emergency preparedness leaders about their EPT training needs. Dozens of meetings were required with university officials, including those from the Office of the President, the Board of Trustees, the Office of the Dean, Medical University Hospital Disaster Preparedness Committee, Public Relations, and Public Safety. A statewide survey of hospital Emergency Medicine Directors was completed to further refine our EPT goals, objectives, and content.[39]

The Advisory Committee set a goal to recruit medical students to complete the first demonstration of the EPT curriculum. Working with the College of Medicine, 10 fourth year medical students volunteered and were enrolled. A second cohort of 17 practicing providers from the Department of Veterans Affairs (VA) were recruited and voluntarily enrolled in the course. The group represented a VA committee from the Emergency Management Strategic Health Care Group (EMSHG) and consisted of physicians, nurses, and emergency managers from across the United States and Puerto Rico. All participants signed a "Consent and Waiver" prior to the course. The project was approved by the University Institutional Review Board.

Research metrics

The task force developed an online pretest and two post-tests for trainees using a pool of questions developed to meet the learning objectives and competencies of the course. The pretest consisted of two parts. In the first part, Likert-scale self-assessment questions measure trainees' sense of personal capability and comfort level to handle a disaster. The second part included 23 discrete multiple choice questions.

The post-test consisted of three parts. The first part was identical to the first part of the pretest (Likert-scale self-assessment questions). The second part contained 23 discrete multiple choice questions. To ensure that students were not answering by memory, some answer orders and questions stems were modified. For example, one post-test question described the same patient triage scenario in the pretest but assigned different vital signs to the patient so the triage answer was "red" instead of "yellow." The third part of the post-test consisted of Likert-scale and open-ended questions for trainees to evaluate course content and instructors. Trainees were asked to complete the same post-test 4-6 months following the training.

Patient outcomes during the mass casualty scenario were central to our experimental focus and were measured primarily using performance criteria "checked off" by CHPTER researchers observing trainees in the human performance lab. The end product was a single list of "met" performance objectives for each team performance. Observers had the opportunity to complete any part of the checklist they did not have time to finish with the help of the digital playback. Once a single list was complete, we simply recorded the percentage of met performance objectives from each group. Any data missing from an evaluation checklist was considered an "unmet" performance objective.

Descriptive statistics such as means, standard deviations, medians, etc, were used to describe elements of the EPT training, as appropriate. Wilcoxon rank sum tests were used to compare the pretest and post-test values within the cohorts of College of Medicine students and VHA trainees. Because many of the pretests and post-tests were completed by the same individuals, and because the test was completed anonymously (thus making it impossible to conduct paired testing), the p-values obtained from the Wilcoxon rank sum tests are conservative estimates. In other words, if we had been able to link subject's pretest and post-test scores and perform a paired analysis, the resulting p-values would have been smaller than what was observed in the independent testing done by the Wilcoxon rank sum test.[40]

Training days

Before arriving at the training session, participants completed the pretest and some online training modules discussing basic concepts and terminology of EPT. (The same pretest, post-test, actors, facilitators, slides, small group exercises, and simulated disaster scenario were used for all trainees.) On the day of training, students signed consent forms and were given the pretest—via laptops available in the classroom—if they had not already completed it online. During module 1, participants were given a presentation about CHPTER and expectations for the course (Table 2). For module 2, trainees watched a presentation about prestage planning and clinical teamwork, and they also performed a small group exercise in teamwork. For module 3, participants listened to a presentation about clinical disaster scene operations, and they engaged in a small group exercise about clinical disaster communication. In module 4, the course trainees received a presentation on personal safety and triage, and they worked to complete a table top triage exercise. All small group exercises lasted for 20 minutes in the given modules. After a 1-hour lunch break, participants were randomly assigned to a small group to participate in the clinical casualty scenario, influenza-like illness. Participants were faced with deciding how to prepare for dealing with the given scenario, what PPE to use, how to triage patients presenting to the ER, and how to deal with unexpected complications that arose during the 6-minute exercise. Participants worked with both standardized patients (actors) and high-fidelity simulation mannequins (Figures 3-7).

The mass casualty incident (MCI) exercise lasted approximately 3 hours. After completing the first scenario, each team received a debriefing in a private viewing room with digital playback screens (Figure 8). The last hour of the course was dedicated to completing the post-test and a course evaluation. Trainees were notified that they would receive the follow-up test online by e-mail in 4-6 months.

Student assessment

Ten medical students received approximately 9 hours of training at the university simulation center and 17 physicians, nurses, and emergency managers from the Department of Veterans Affairs EMSHG were provided the same 9-hour course. A review of the data supplied by the College of Medicine shows that the medical students significantly valued the curriculum and felt their EPT knowledge and skill increased. Most (70 percent) of the trainees considered their EPT knowledge and/or skill average or below average before the training experience. After

Figures 3-7. Trainees interacting with actors and human simulators during multiactor disaster scenario.

the curriculum, 80 percent of trainees considered their EPT knowledge and/or skill above average, and 90 percent would recommend the course to other patient care providers (Tables 3 and 4, Figure 9). The performance data of both cohorts will be presented in a follow-up publication.

Discussion

Efforts to foster EPT to medical trainees in a simulated environment date back to the 1950s when researchers assessed the use of movies to augment students' training for military and disaster events.[41] The IOM's 1999 report, "To Err is Human," spurred new development of the use of human patient simulators to train medical providers.[42] In the 1990s, lessons learned from the aviation industry's Cockpit Resource Management (CRM) led a group of anesthesiologists to pioneer the Acute Crisis Resource Management (ACRM) training module that uses human patient simulators to help reduce error during emergent clinical events.[43-45] Subsequent research has suggested a potential benefit of human simulators to train patient care providers for

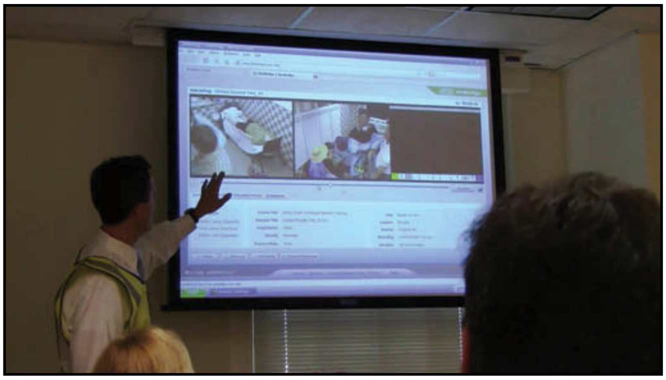

Figure 8. Postscenario debriefing with trainees using recorded digital feeds of student performance.

Table 3. Percent of medical trainees who would recommend the CHPTER EPT course		
Q: I would recommend this course to next year's class		
No answer	0	0
Strongly disagree	0	0
Disagree	0	0
Neutral	1	10 percent
Agree	1	10 percent
Strongly agree	8	80 percent
Total	10	100
Source: College of Medicine 2011 course evaluation.		

clinical emergencies.[46-51] Research also suggests that simulators are warmly received by health professional students and can enhance their learning experience.[52-56]

Early applications of simulation to emergency medicine include its efficacy to provide emergency medicine team training,[57] a pilot study of simulation to provide Emergency Medicine Crisis Resource Management (EMCRM) training[58] and the theoretical use of multiple patients during simulation to replicate the chaotic environment in the ED.[59] Other descriptions of simulation in emergency and military medicine are available.[9,13,27,57,60-67]

We performed a literature search in the PubMed database using the MeSH controlled vocabulary terms "disasters" and "disaster planning." Then, we searched for the keywords "training," "education," or "simulation." We then combined the three sets, limiting to evidence-based articles. To augment this search, we also performed a PubMed search looking for "simulation AND training AND disaster." Additional online searches were completed to capture government reports from, for example, AHRQ (*www.ahrq.gov*). Our search yielded approximately 350 articles and reports.

Several evidence-based studies were found that established the efficacy of human simulation to train patient care providers for a disaster. Kyle used a combination of human actors and simulators to recreate a Weapons of Mass Destruction exercise.[68] Lerner used a combination of actors and simulators to test the accuracy of SALT triage.[69] Subbarao used a combination of video and high-fidelity human simulators to train teams of EMS/fire medical providers to treat victims of chemical, biological, radiological, nuclear and explosive disasters.[32] Summerhill used a prospective cohort design to help show how human simulation increased internal medicine resident's scores on bioterrorism written tests.[70] Miller showed that health professionals (mostly EMS) would improve their confidence after using

Table 4. Medical trainee self-assessment of EPT knowledge or skill				
	Q: My overall knowledge (or skill) of this topic before the course was . . .		*My overall knowledge (or skill) of this topic after the course was . . .*	
No answer	0	0	0	0
Poor	1	10 percent	0	0
Below average	4	40 percent	0	0
Average	2	20 percent	2	20 percent
Above average	1	10 percent	4	40 percent
Outstanding	2	20 percent	4	40 percent
Total	10	100 percent	10	100 percent
Source: College of Medicine 2011 course evaluation.				

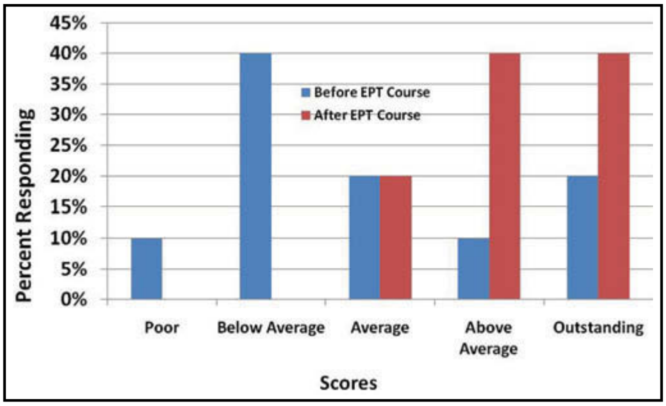

Figure 9. Medical trainee self-assessment of EPT knowledge or skill (source: College of Medicine 2011 course evaluation).

human simulators in a HazMat scenario.[12] Vincent had medical students listen to podcasts about triage and then showed that students would improve triage accuracy after repeating scenarios with human patient simulators.[63] Finally Gillett used paired scenarios consisting of one simulator and one actor to measure the value of simulation versus actors in EPT for physicians, residents, nurses, and medical students.[71]

We found only one study that used a multiactor clinical disaster scenario to measure the life-saving performance of medical trainees. Wallace quantified the disparity between the times required to resuscitate simulators and actors during a simulated disaster drill. Six simulators and six actors were presented to triage teams in waves of three patients at a time.[72] Because the maximum number of patients during an individual triage encounter was limited in Wallace study, it is not clear whether the tested curricula would have an impact on trainees during a clinical disaster scenario with greater than 10 patients at once.

Here, we present the methodology for the development of CHPTER's 1-day clinical EPT course for patient care providers. We also present the self-assessment and course evaluation data provided by the College of Medicine for students who took the course. Students who completed the course improved their overall knowledge and comfort level with EPT skills. In a subsequent study, we will present comprehensive data of our medical student and practicing clinician cohorts, including their self-assessment, precognitive performance and postcognitive performance, small group and MCI scenario performance, and course assessment. To our knowledge, this is the first published description of a curriculum method that combines high-fidelity, multiactor scenarios to measure the life-saving performance of patient care providers utilizing a clinical disaster scenario with >10 patients at once.

We believe this course, and the comprehensive validation data to follow, represents the first step of the next generation of EPT for patient care providers. Our course creates a loud and chaotic clinical disaster that measures life-saving performance, not just life-saving knowledge. Our course is short, addressing a primary obstacle to EPT in our region and a request from providers that courses be limited to 1 day.[39] Our EPT is "all hazards" and applies toward multiple disaster environments. Finally, our EPT includes First Receivers (ie, clinicians, hospital workers, mental health providers, public safety officials, and community volunteers) who may receive and care for patients during a disaster but will not necessarily participate on the disaster scene. This addresses a critique of some widely available EPT programs that tend to focus on First Responders (EMS, HazMat, and fire personnel) who mitigate a disaster scene.[73] Because 60-85 percent of patients will circumvent First Responders during a large-scale disaster,[1,74-79] we strongly support the broadening of traditional EPT programs in the United States to recognize the unique training needs of First Receivers.

Limitations

We set out to develop a realistic multiactor disaster scenario that includes research metrics to measure EPT performance. In some respects, the more real our disaster EPT scenarios became, the harder it was to control the testing environment, reducing the accuracy of our measurements. We sought to enhance reliability in this study with the use of technology that enabled us to 1) repeat the same educational intervention (ie, small group exercise and simulated disaster) over and over without significant deviation of training events; 2) multiple training facilitators assigned in a "zone" format to ensure that trainee actions were not missed; 3) laptop computers linked to high-fidelity mannequins that permitted time-stamped recordings of trainee-patient interventions; and 4) a total of four digital video feeds that permitted both facilitators and trainees opportunity to review scenario performance. With the help of one-way glass and headphones, facilitators were able to communicate in relative isolation to mitigate loud noise and other distractions. While still possible that observers missed performance objectives, we feel this potential was minimized.

It is important to note that when we estimate trainee performance in this study, team performance is used as a proxy for individual performance. We could have reorganized the study to measure individual trainee actions during the disaster scenario. We did not do this primarily for time constraints but also because we felt that patient care providers are more likely to work within a team during a disaster. Therefore, team performance is a valid performance endpoint for our study.

We did not perform a cost per student assessment and recognize that in the era of declining budgets, cost performance metrics are key to ensure scalability and wide spread dissemination of training. In addition, the power assessment of this demonstration project (n = 27) is low and the external validity of this curriculum has not been established. A larger scale study, or preferably a multicenter trial with cost assessment, would allow us to further expand on the impact, validity, and scalability of our curriculum.

Conclusions

Here, we present the methodology for the development of a 1-day clinical EPT course for patient care providers, including its organization, core competency and content development, medical student self-evaluation, and course assessment. To our knowledge, this is the first published description of a curriculum method that combines high-fidelity, multiactor scenarios to measure the life-saving performance of patient care providers utilizing a clinical disaster scenario with >10 patients at once. A larger scale study, or preferably a multicenter trial, is needed to further study the impact of this curriculum and its potential to protect provider and patient lives. For further information regarding the curriculum, including a short video that details the patient care provider experience, please visit *www.musc.edu/chpter*.

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