

EDUCATIONAL ADVANCES

A Multiphase Disaster Training Exercise for Emergency Medicine Residents: Opportunity Knocks

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Abstract

Background: Disaster planning is a core curriculum requirement for emergency medicine (EM) residency programs. Few comprehensive training opportunities in disaster planning incorporating the appropriate competencies have been reported. **Objectives:** To design, pilot, and evaluate a combination interactive Web-based disaster planning curriculum and real-time multidisciplinary full-scale disaster exercise. **Methods:** Residents were assigned to groups led by a faculty mentor. Each group used an Internet-based platform to review the literature pertaining to their component of a disaster plan. The groups then used the platform to redesign an existing institutional disaster plan. Finally, they implemented their disaster plan for 80 simulated casualties resulting from a police, fire department, and emergency medical services multiple-casualty rescue exercise. All health professions then participated in a joint debriefing session. All aspects of the program were

supervised by specialty EM faculty, and the exercise was evaluated using a five-point Likert scale with specific anchored descriptors. **Results:** Sixteen residents and 17 faculty members participated in the exercise. Trained volunteers and high-fidelity simulations represented casualties varying in age from 6 months to 65 years, and in severity from ambulatory to moribund. Residents found the exercise enjoyable (4.9/5), relevant (4.6/5), and educational (4.8/5). **Conclusions:** Emergency medicine residency programs can benefit from participating in high-quality medical disaster exercises coordinated with local disaster response agencies. Residents report high satisfaction and learning from realistic simulations of disasters, and from collaboration with other community services. **Key words:** residency; emergency medicine; disaster; simulation; training. *ACADEMIC EMERGENCY MEDICINE* 2005; 12:404–411.

Emergency physicians (EPs) must provide more than excellent patient care in times of disaster. They must contribute to such complexities of the initial response as triage; judicious resource allocation; integration of emergency medical services (EMS), fire, police, and other community partners' responses; and maintaining control of the medical effort. While these skills often require improvisation, practice improves their successful implementation.¹

Since World War II, the need for improvement in disaster medicine training has been acknowledged by governmental and educational institutions.^{2–9} The World Trade Center terrorist attacks and subsequent anthrax threats of 2001 and the severe acute respira-

tory syndrome (SARS) epidemic of 2003 provide convincing recent examples of the continued need for such training. Disaster planning has become a core curriculum requirement for emergency medicine (EM) residency programs.^{10,11} The topic also provides an excellent opportunity to emphasize the development of the core physician competencies of communication, collaboration, and management skills.^{12,13}

The majority of health care centers remain ill prepared to deal with a disaster situation.^{1–4,14,15} The lack of a widespread standardized curriculum to train EM residents in disaster medicine may contribute to this deficiency.^{2,4,6,7,9} Disasters are rare events, and few residents, therefore, will directly encounter the critical scenarios that they may eventually face during their practice. This creates a challenge, since practical hands-on experiences are thought to provide the most intense and educationally valid learning opportunities.^{5,7}

In response to these challenges, a few groups have reported preliminary work in the area of simulation-based EM training using Web-based programs, computer-enhanced mannequins, and virtual reality.^{6,7,16–19} Notably, in 2003, Rezneck et al. adapted the highly successful Anesthesia Crisis Resource Management (ACRM) model to create a simulation-based crisis management course for EM residents.⁶ We know of

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no EM resident disaster medicine training exercise that has integrated an Internet-based pre-event planning process with an actual large-scale disaster exercise carried out with the cooperation of relevant public service personnel. We sought to design, carry out, and evaluate such an exercise.

METHODS

Study Design. The overall timeline for development and execution of the exercise is shown in Figure 1. In our city, police, fire, and EMS services are responsible for the initial response to disasters and were planning a full-scale simulation exercise. Organizers agreed to the participation of medical learners to allow the exercise to be carried through to emergency department (ED) patient care. We identified a faculty leader to develop an educational intervention for EM residents, including a mock ED to receive casualties from the training exercise. EM disaster planning core learning objectives were reviewed (in our case from the Royal College of Physicians and Surgeons of Canada core curriculum) and a list of resident-specific objectives was constructed. Based on this list, we developed a comprehensive disaster-planning curriculum. The curriculum was taught by interested faculty who were recruited to guide residents through the analysis and resynthesis of an existing Code Orange Disaster Plan, which was then tested on the event day. Four faculty members, including the leader, had some formal disaster medicine training, and three were heavily involved in out-of-hospital care administration. The remainder had basic disaster medicine education during their residency programs.

Overview of the Exercise.

1. Pre-event Phase. In preparation for the exercise, termed the Disaster Training Initiative (DTI), residents and nurses were assigned to groups with a faculty mentor and given access to an Internet-based distance education program (<http://www3.sympatico.ca/pf.arnold/mass2003.htm>). Each group was assigned a specific topic within disaster planning to research and analyze. The participants were informed that an exercise to implement their plan would take place, but were not given details about the event. The Web site included an interactive discussion forum for the participants, which has been password-protected to preserve confidentiality. During September and October 2002, participants were expected to research their topic and post their findings on the Web site, to be viewed by their colleagues. In so doing, the group developed a current, comprehensive database of disaster management. The second stage of the preparatory process, in November and December 2002, required residents and nurses in groups to analyze and critique an existing hospital disaster plan, and to make suggestions

for improvement in areas such as charts, equipment, and triage. During the first two weeks of January 2003, participants merged their content areas and constructed their own disaster plan that would be implemented on the day of the exercise. Residents and nurses at this time were assigned specific roles in the mock ED. In keeping with the principles of graded responsibility, senior residents were assigned to managerial roles, such as site commander, physician in charge, or EMS dispatch coordinator. More junior residents were assigned to specific clinical duties, such as serving on the trauma team.

While the faculty led the discussion sessions, they also participated in developing scenarios and gathering materials in support of their cases. The cases were coordinated by the faculty leader to ensure they were realistic, covered a broad range of age, anatomy, and acuity, and included examples of penetrating, blunt, and emotional trauma. Several sample cases are shown in Appendix A (available as an online data supplement at: <http://www.aemj.org/cgi/content/full/12/5/404/DC1>).

2. Event Phase. In total, more than 100 individuals participated in the simulated disaster, including Toronto Police Tactical Team members, paramedics, EM nurses, EM residents, and faculty from the divisions of EM. On the day of the exercise (January 21, 2003), residents began their mornings at the regularly scheduled academic half-day. When the exercise commenced, the residents were called out of rounds and shuttled to the mock ED, created in the gymnasium of a local office building (EMS and fire training facility). The actual simulation took place in the hallways and grounds of the facility. The disaster scenario involved two gunmen shooting random victims and detonating a bomb in a high school. The police tactical force apprehended the assailants and secured the scene, after which fire and EMS carried out a triage, treatment, and rescue operation.

Upon arrival at the facility, residents assumed control of a full mock ED, with faculty members assuming the temporary roles of existing ED patients. Those residents who were cast as active EPs were instructed either to discharge or to expeditiously admit these patients, to make room for the incoming disaster victims; this also allowed faculty members to revert to their supervisory roles. The remaining residents took up their assigned positions in the disaster plan. Each resident had a faculty supervisor who was in possession of detailed patient summaries for all simulated patients for the day (see abbreviated case examples, Appendix A [available as an online data supplement at: <http://www.aemj.org/cgi/content/full/12/5/404/DC1>]). Patients arrived with an identification number corresponding to their simulated casualty, and the supervisor then guided the resident through the management of the case. Patients

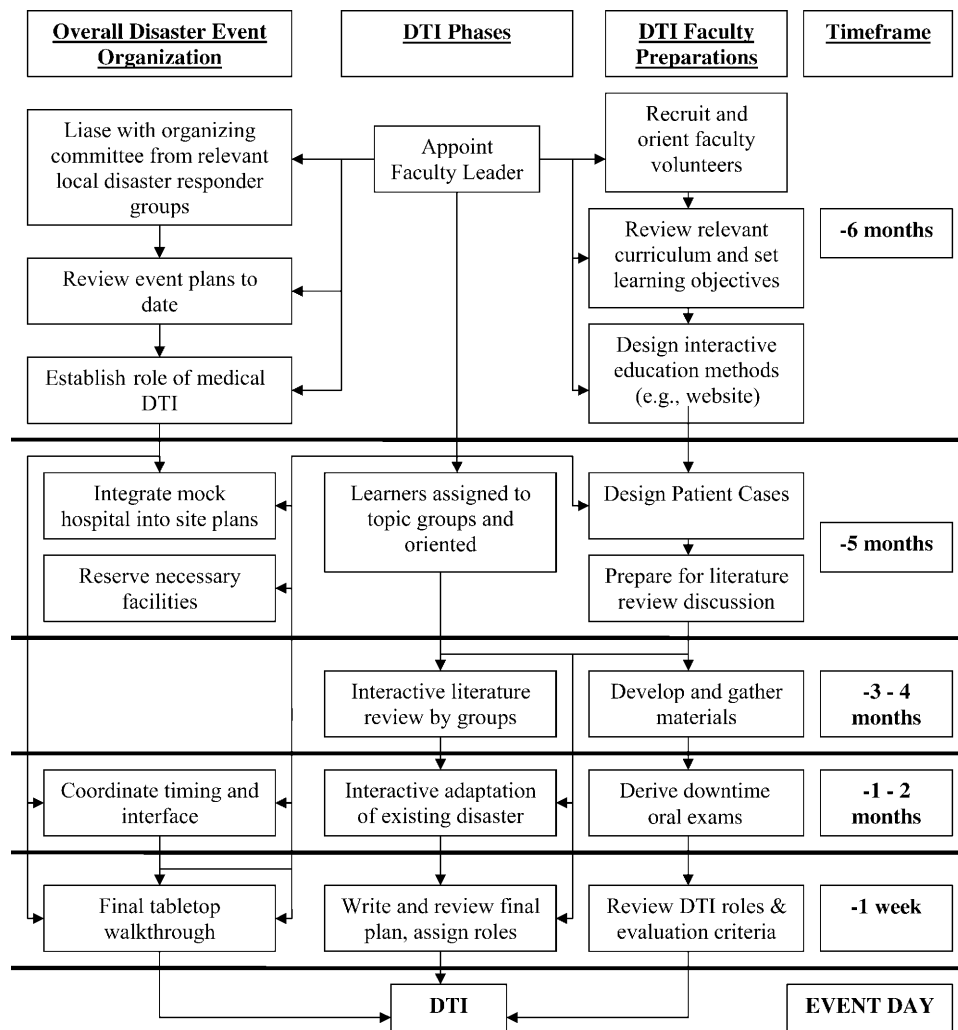


Figure 1. Flowchart of Disaster Training Initiative (DTI) organization and execution.

were not distributed to areas of the hospital in a predetermined fashion; instead, residents made all triage decisions. While awaiting patient contact, residents were given on-the-spot mock oral examination questions by their supervisors and teaching around topics of relevance to the scenario, as determined a priori by the organizing committee.

Over the next 90 minutes, student paramedic crews delivered approximately 60 casualties to the mock ED. Patients ranged in age from an infant visitor to the school (with a hysterical mother) to a 65-year-old school employee. Clinical presentations ranged from superficially wounded to moribund. Trained volunteer paramedic students enacted the majority of casualties, with makeup provided by a local post-secondary school dramatic arts program. Pediatric patients and some adult cases were simulated with mannequins.

Residents were provided with no patient information prior to their interaction with individual victims. Access to resources was very realistic, as residents and nurses used charts, monitors, intravenous catheters, and intubation equipment. Residents were

expected to order tests and perform basic procedures on models and mannequins. Their supervisors enforced specific “downtime” for each intervention, such as would be required to transport a patient to the computed tomography (CT) scanner. During the “downtimes,” residents were kept busy with more oral examination questions. The disaster plan continued until treatment and management plans were in place for all casualties.

Residents were given feedback on how well they handled their aspects of the disaster, and on specific procedures they carried out. This was carried out using global assessment forms developed specifically for the exercise. The evaluations were completed immediately by faculty supervisors and given to the residents as a timely, contextual critique. The forms were used as feedback rather than evaluation, and data on individual resident performance were not collected as part of this initiative.

3. Post-event Phase. Upon completion of the exercise, all residents and faculty participated in a debriefing session. Feedback was solicited from the

residents about the organization of the event and how they felt as physicians responsible for carrying out the disaster plan. Following this, all participating services (EMS, fire, police, and medical) gathered in the auditorium for an overall debriefing and discussion session, in which each group was provided a summary of the experiences of the other groups. In the two weeks following the event, participants had access to a Web-based chat room to further elaborate on their thoughts regarding the event and the lessons learned.

Evaluation Data. Following their participation in the DTI, residents were asked to fill out a postexercise evaluation form describing their thoughts on the day. The survey consisted of ten questions with responses provided on anchored five-point Likert scale, with a score of 1 being least favorable and 5 being most favorable. Descriptive analysis was planned as a measure of overall resident perception.

RESULTS

Eighteen residents participated in the inaugural event. The residents ranged from postgraduate years 1 to 5 in level of training; 14 were specialty EM residents from a five-year training program, and four were third-year residents enrolled in the Canadian College of Family Physicians EM certification year.

Fourteen of the residents completed the postexercise evaluation forms (Figure 2). They reported that the scenarios were extremely enjoyable (mean 4.9/5, standard deviation [SD] ± 0.3). They appreciated the Internet-based preparatory phase. Most importantly, residents found the scenarios to be realistic and relevant (mean 4.6/5, SD ± 0.7), and believed that they gained valuable knowledge toward their future practices in EM (mean 4.8/5, SD ± 0.4). Faculty mentors

also highly valued the exercise and believed it contributed to their confidence around disaster management. The lowest score on the evaluation survey was for "enough time" (mean 3.6, SD ± 0.9), suggesting that the residents would have preferred an even longer exercise. The event relied on the conduction of a previously planned annual exercise and volunteers. The DTI was therefore completed with no charges incurred on the part of the residency program.

DISCUSSION

In 1998, the Centers for Disease Control and Prevention (CDC) identified EPs as playing a pivotal part in coordinating the medical effort of a disaster, but noted that there is a relative lack of preparedness among health care providers in managing external threats.²⁰ Indeed, a 1998 survey of 118 EM residency programs in the United States revealed that only 53% had formal training in biological terrorism and, of these, only 10.9% involved teaching outside the classroom.² We took an innovative approach to disaster education that involved residents both in the background research necessary to develop a disaster plan and in a full-scale mock disaster. In doing so, we were able to emphasize the specialty physician competencies of manager, collaborator, and communicator.

There are five major strengths of the DTI that give it a singular depth and creativity. First, the longitudinal Internet-based course spanned four months, providing a particularly comprehensive initiation to the planning and practice of disaster medicine. The residents developed an appreciation of the multiple facets of disaster planning in an interactive, supervised environment. The actual event provided residents with the practical, hands-on experience of managing a disaster. Learners saw firsthand the consequences of their efforts in the planning stages. Second, the involvement of multiple community stakeholders (in our case EMS, fire, and police) makes the exercise uniquely relevant and instructive. It is crucial that EPs can interface effectively with whatever different community and health care partners they are likely to encounter in a real local disaster.²¹ The DTI facilitates this. At the conclusion of the exercise, a post-event debriefing session allowed residents to articulate their experiences from the day, and also learn from the reflections of nurses, medical support staff, and nonmedical personnel. Particularly, the residents were able to discuss the concerns, limitations, and capabilities of the other professional cohorts in the context of the disaster exercise. Third, this program can be easily adapted to other systems of education or disaster response. Programs looking to duplicate these efforts should identify resources relevant to their local circumstances, such as military personnel, and base their curriculum on relevant educational standards for their learners. The lack of

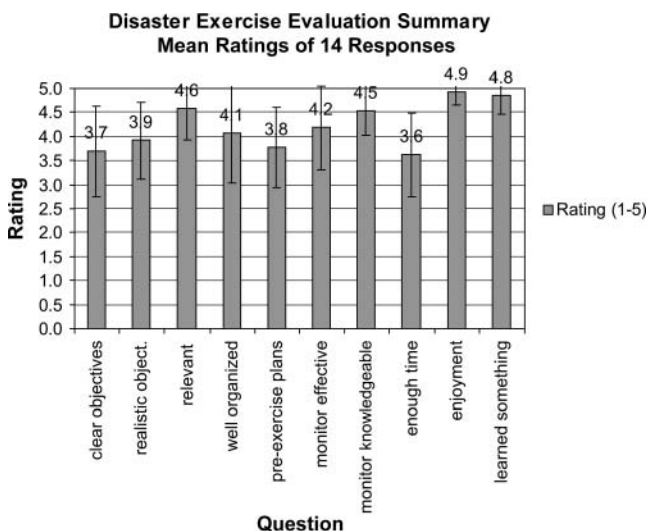


Figure 2. Resident perceptions following participation in the Disaster Training Initiative (DTI).

expertise with Internet-based education should not preclude the use of this design, as weekly workshops or e-mail lists could facilitate the exchange of ideas in similar ways, and may even have benefits over a Web-based design. Fourth, repeating this event allows residents to be cast each year in roles of increasing leadership and logistical decision making. This graduated responsibility gives residents an excellent progression of training, leading up to the role of medical officer in charge, which they will ultimately assume in their practices as EPs. Finally, the exercise was carried out without material cost to the residency program. All faculty were volunteers, and facilities were made available through local cooperating agencies and government.

Many of the problems faced in disasters are not caused by shortcomings in medical competence, but rather from failures in leadership and management.^{4,7} It is for this reason that the physician roles of collaborator, communicator, and manager are so particularly stressed in the DTI. In more traditional curricula, residents may review pre-existing disaster plans and get exposure to the principles of their design.¹⁹ In the DTI, residents developed their own disaster plan based on existing institutional models, including the planning, decision making, and resource allocation necessary for the manager role. The collaborator role is paramount as residents work with staff, nurses, and colleagues to develop the plan; interact with all forms of personnel in its execution; and share in the collective educational debriefing process. Finally, residents are taught the importance of communication throughout the DTI. They must be able to describe their ideas in the planning phase, be clear and effective in their communication with clinical colleagues during the disaster phase, and articulate their thoughts to a large group afterwards. Learners were provided with explicit feedback in all of these areas during the individual sessions with their supervisors.

The DTI demonstrates that high-quality disaster management exercises can be born out of collaboration with other organized stakeholders in the community at minimal extra cost. In its second year of operation (April 2004), the DTI doubled in size, added ultrasound imaging and computerized simulation, and incorporated advanced communication technologies (video teleconferencing, patient tracking, etc.), much to the enjoyment of hospital and government observers. The updated DTI Web site can be accessed at <http://www3.sk.sympatico.ca/halbr2/emdmc/stage4/stage4intro.html>.

LIMITATIONS

Many opportunities to improve this relatively new initiative exist. It would be interesting to conduct a formal evaluation to determine exactly how much residents learn from the experience. We evaluated

neither amount of content learned nor retention of knowledge. Residents were evaluated on their performance during the event, which assessed only their demonstrated abilities in a specific area. We report here only residents' perceived knowledge gain. There was some heterogeneity in the expertise and skills of the mentors; some also learned a great deal from this exercise. While this variability may have served to role model life-long learning for trainees, the program would likely be improved by providing mentors with a more rigorous course structure to ensure a uniform experience for all residents. Lastly, during the exercise, different faculty supervisors had varying impressions of the duration of "downtime," explicitly stipulating these and other rules for the DTI could help to achieve the consistency necessary for optimal fidelity of simulation.

CONCLUSIONS

Opportunities exist to successfully combine medical disaster exercises with those of ancillary community services. Residents enjoy and report learning from such activities. Using the DTI model, EM residency programs can economically train residents in the art and science of disaster medicine with emphasis on collaboration, communication, and management.

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REFLECTIONS

Reflections on a “Combat Sabbatical”

“When you reach the end of your rope, tie a knot in it and hang on.”—Thomas Jefferson

Writing this passage, I am halfway through a yearlong tour as an armored cavalry battalion surgeon stationed near the Sadr City subdivision of Baghdad. My title, reflecting two centuries of “tradition unimpeded by progress,” is the U.S. Army’s euphemism for a physician supporting front-line troops. Being a career Army medical officer, and having undergone the typical indoctrination into the profession of arms, I have been exposed to numerous quotes by notables reflecting on similar experiences. Now having experienced it firsthand, many of those aphorisms ring with a new truth, at least to me.

“Do what you can, with what you have, where you are.”—Theodore Roosevelt

While not at all unwelcome, my current environs throw into stark contrast my usual life in “the world.” While it is literally half a world and seemingly a lifetime away, my “daytime job” as teaching faculty at an Army emergency medicine residency program served as remarkably good preparation for my duties here. On the other hand, despite its challenges, isolation, and small tragedies, this time “in the breach” has been an opportunity for both personal and professional reflection, not unlike a sabbatical, of sorts.

“War is hell.”—William T. Sherman

Let there be no doubt about it. This quote, however, takes on a deeper meaning than one simply relating its terrible effects. I have observed through many unfortunate events not only the horrors of war, but also a characteristic randomness, a lethal chaos, which, to my mind, can be nothing short of diabolical. Let there be no doubt, hell is in session—you need only to look anywhere there is an active armed conflict.

“...when again touched, as surely they will be, by the better angels of our nature.”—Abraham Lincoln

Yet we have encountered events that have been nothing short of miraculous, as well. Soldiers and civilians surviving catastrophic explosions and sharp firefights, sometimes unscathed; unlooked-for warnings about enemy ambushes coming from local citizens in the middle of the night; miraculous “saves” by medics, doctors, and physician assistants when by all established metrics a patient should have died; all subtle yet telling signs that lead one to believe someone or something is watching out for us.

“Practice random acts of kindness and senseless beauty.”—Anonymous

I sometimes wonder if the author of this quotation really understands what it means. Nonetheless, despite the random acts of violence and senseless cruelty visited upon us daily in the form of improvised explosive devices, mortars, and rocket attacks by our adversaries, many of our soldiers practice the former creed quite actively. Lest the reader mistake us for being self-righteous or falsely pious, let me assure you that our actions are not always motivated by pure altruism. It is a remarkably empowering experience to do a kindness for someone for no other reason than simply because it is the right thing to do. It also reinforces the fact that despite everything that is going on around us, we are, in essence, still human beings.