Disaster Medicine Training in Family Medicine: A Review of the Evidence

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Family physicians play a critical role in responding to the medical needs arising from both natural and man-made disasters (Table 1). When disasters strike, they are at the front lines of the response in their communities. The reliance on local physicians in the early days of disasters was illustrated in the recent Haiti earthquake. Knowledge of how to respond to disasters and coordinate that response with other agencies and organizations is essential.

The literature suggests that physicians as a group are unprepared for this role, due to inadequate training and limited experience. Most professionals will not have real disaster response experience prior to being called to respond. Though there is limited evidence on the effectiveness of disaster training, such activities make intuitive sense and have been discussed for decades. A call for expanding disaster medicine training was published in 1995, yet standardization of this training is lacking. Paradoxically, one study even suggests that disaster medicine education has decreased since 9/11. The Accreditation Council for Graduate Medical Education’s (ACGME) Residency Review Committee (RRC) revised common program requirements for family medicine require that “community medicine…curriculum should include…disaster responsiveness.” So how do residency programs teach this new competency?

In 2003, the American Academy of Family Physicians, in collaboration with the Society of Teachers of Family Medicine, the Association of Departments of Family Medicine, and the Association of Family Medicine Residency Directors published a curriculum guideline on this topic. The subject of major revision in 2008, an update is due for release in 2010. In this document, they call for the competencies shown in Table 2. Focused on the provision of urgent clinical care, some emergency medicine (eg, rescue and recovery techniques) and public health (eg, provision of water and sanitation) topics are outside the scope of the current guidelines.

These competencies are consensus based rather than evidence based. Limited data is available regarding the effect of proficiency in any of these areas on patient-oriented outcomes during disasters and is contradictory in some cases—notably in the area of critical incident stress management. Most research has been done with other learners than those in family medicine. In spite of the lack of evidence of efficacy, disaster preparedness is being implemented on a large scale. Lack of evidence of benefit is not synonymous with evidence of lack of benefit; research into the most effective approach to disaster preparedness is ongoing.

In this paper, we summarize the evidence in the literature supporting the efficacy of training for each of the competencies set forth in the Curriculum Guidelines. It is not our intent here to debate or rewrite the

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established Guidelines but to review the available evidence for training in these competencies. Following a description of our methods, the results for training in each competency will be presented in the order in which they appear in the Guidelines.

**Methods**

We reviewed the literature for evidence of the efficacy of training in disaster medicine in general and in the specific competencies. Evidence was identified via electronic search of medical and educational research literature databases: PubMed, ERIC, and ERC. Search terms included “disaster medicine training,” “safety training,” “ICS training,” “incident command system training,” “NIMS training,” “national incident management system training,” “disaster triage training,” “mass-casualty training,” “psychological first aid training,” “critical incident stress training,” and “education” substituted for “training” in all the above searches. In addition to the “safety training” search results, 695 separate papers were identified. Excluding those that presented training programs without reference to outcomes of any sort, those not addressing disaster situations, and commentary pieces, a total of 37 remained that presented data on effectiveness of training, including nine systematic reviews. Only five studies addressed physicians specifically; the remainder had a health care team focus. Evidence of effectiveness of training was limited

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<td>Meteorological (eg, hurricane, blizzard, heat/cold wave)</td>
<td>Transportation (eg, airplane, bus, train)</td>
<td>Bombing</td>
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<tr>
<td>Geological (eg, earthquake, volcanic eruption, flood)</td>
<td>Structural (eg, building or bridge collapse)</td>
<td>Shooting</td>
</tr>
<tr>
<td>Other (eg, fire, explosion, disease outbreak)</td>
<td>Nuclear (eg, radioactive waste release, meltdown)</td>
<td>Nuclear/radiological (eg, fissile bomb, “dirty” bomb, or other types of radiological poisoning)</td>
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**Table 1: Types of Disasters**

- **Natural**
  - Meteorological: hurricanes, blizzards, heat/cold waves
  - Geological: earthquakes, volcanic eruptions, floods
  - Other: fire, explosions, disease outbreaks

- **Accidents**
  - Transportation: airplanes, buses, trains
  - Structural: building or bridge collapses

- **Intentional Acts of Violence**
  - Bombing
  - Shooting
  - Nuclear/radiological: fissile bombs, “dirty” bombs, radiological poisoning

Although intentional acts of violence may involve similar events and affect a similar number of victims, they may be sub-classified as either criminal acts (in which the focus of the act is the victim) or acts of terrorism (where the focus of the act is society).

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<th>Patient Care</th>
<th>Systems-based Practice</th>
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<td>A basic understanding of the primary importance of safety in disaster responses, including personal protective equipment, decontamination, and site security.</td>
<td>An understanding of the principles of triage and the ability to effectively perform triage in a disaster setting.</td>
<td>A basic knowledge of the National Incident Management System (NIMS) and the Incident Command System (ICS), including its application to the planning, coordination, and execution of disaster responses.</td>
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<td>The clinical competence to provide effective care in a setting of extremely limited resources.</td>
<td>An understanding of psychological first aid and caring for responders</td>
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primarily to changes in knowledge and attitudes, with occasional measurement of skills or performance indicators. We found that reports of actual benefit in patient-oriented outcomes attributable to improved training in disaster medicine competencies are virtually nonexistent. Among the 17,757 references found by our search for safety training and education, we found only two studies of the effectiveness of safety training for disaster responders.

**General Disaster Medicine Training**

Several formats of disaster training have been used, including didactic-lecture sessions, simulated disaster drills, tabletop exercises, and computer simulation. These have demonstrated measurable educational effect, though the effect of this training on patient-oriented outcomes in actual disasters has not been studied. In 2004, the Agency for Healthcare Research and Quality (AHRQ) released an Evidence Report evaluating the literature on the effectiveness of these modalities in preparing hospital staff, including physicians, for mass casualty incidents. Extracting and synthesizing data from 21 studies, it found adequate literature to suggest that simulated drills were effective, with the caveat that methodological weaknesses limit the strength of these conclusions. Outcomes measured reflected process-oriented and knowledge-oriented, rather than patient-oriented, outcomes. This translates to SORT=C. They found insufficient evidence to comment on the effectiveness of computer simulations or tabletop exercises. In the studies the authors cited, measures included debriefings, interviews, self-assessments, chart reviews of simulated patients, or observer evaluations; none included real-world disaster outcomes.

A 2008 systematic review of literature subsequent to 2000 on the effectiveness of disaster training for health care workers found insufficient evidence to determine if training interventions are effective in improving disaster knowledge and skills, based on the nine studies that they identified. The same year, a small, single institution, prospective, randomized, controlled, longitudinal study was reported. Eighty-five subjects were enrolled in an investigation to evaluate (1) didactic lectures and (2) lecture/tabletop-exercise combinations in training for management of pediatric disaster victims. Both interventions increased participants’ scores on objective multiple-choice tests, but those who completed the combination form of training reported a greater subjective sense of confidence in their knowledge, which persisted for at least 6 months following the training. Another study reported that a 2-hour, awareness-level course including both didactic and experiential learning was evaluated using written pretests and posttests and showed increased knowledge and moderate retention of pediatric disaster medicine topics among residents.

Computer-based and other simulations have demonstrated improved acquisition of knowledge, though there is some evidence to suggest such methods may not be better than traditional approaches in the acquisition of clinical skills. Unannounced, realistic full-dress-and-moulage mock disasters may be superior to either didactic or other simulation training. Disaster training of health professionals needs to be subjected to scientific rigor to ensure the most effective methods are used.

**NIMS/ICS Training**

Since 9/11, there has been an increased focus on standardization of disaster response in an effort to speed the implementation of relief and decrease the iatrogenic component of the chaos inherent to such situations. In the United States, the National Incident Management System (NIMS) has been developed in an attempt to facilitate a timely, coordinated, and effective response to disasters of any magnitude. NIMS training has been mandated for all response agencies, including health care facilities. Introductory courses are available online on the Federal Emergency Management Agency (FEMA) Web site (Table 3).

**Safety Training**

Responders will often be called to work in unstable or unsafe environments. Yet there is limited literature on the efficacy of safety training in decreasing injuries to responders. Substantially more data are available regarding safety programs in industry and construction settings and are reasonable proxies for disaster settings. A challenge to evaluating the efficacy of safety training is that patient-oriented outcomes (eg, reduced frequency or severity of injury) are not often reported, and when they are, confounding variables are not taken into account. Instead, surrogate measures such as attitude or knowledge are used.

A variety of methods have been used in safety training, including didactic lectures, a variety of simulations, and hands-on exercises. Safety instruction has been implemented both before the event and as “just-in-time” on-scene training. Some authors recommend targeting content to specific subgroups of learners rather than aiming for generality across larger groups, while others find the diversity present in a larger group offers advantages and reflects the multidisciplinary situation of real-world safety issues. Convincing evidence for superiority of large diverse versus small homogeneous groups for safety training remains an open area for research.
Surveys of emergency responders and hazardous materials workers provide self-reported evidence for the value of safety training. A sizable proportion of those answering the surveys reported the occurrence of incidences following their training, for which they found the training adequately prepared them.

Studies using formal assessment tools following completion of a safety program demonstrated that training resulted in knowledge and attitude improvement that was still measurable at 3 months. A comparison of different versions of computer-based training found there were no significant differences between training groups on multiple-choice test scores, but in measures of higher learning (“transfer”), differences were seen. Studies looking for a correlation between safety knowledge and injury experience found no relationship, suggesting that while training may lead to increased knowledge, this does not translate to safer practices. While some have reported no relationship between safety climate and perceived risk, attitude toward risk, or training, others have prospectively found a 16%–25% reduction in injuries following implementation of safety programs.

**Triage Training**

Rapidly identifying the level of acuity, and allocating the available resources to maximize benefit to the population of disaster victims, is the essence of disaster triage. There are a variety of triage systems, covering both the general population and specific subpopulations such as geriatric or pediatric victims. These systems were developed by consensus; there is limited evidence for their efficacy and even less to suggest the superiority of one strategy over another. Nevertheless, some method of prioritizing care must be adopted, and proficiency in triage is important.

Studies indicate that triage-specific training improves performance. Manikin-based simulation has demonstrated efficacy in cross-cultural triage training in the South Pacific. Knowledge and performance scores, speed, and self-efficiency have also been shown to improve via utilization of virtual reality simulation. Some exercises incorporate patient outcome simulations and may allow comparison of different triage training methodologies.

The majority of individuals presenting for medical attention following disasters have chronic and low acuity conditions. As a result, disaster response more often involves a high volume, low acuity patient load rather than a mass-casualty incident. The most widely promoted triage systems fail to address this
situation; additional triage strategies and training need to be developed to facilitate appropriate allocation of available resources for the care of these patients.

Training for Clinical Competence
A study attempting to define clinical competencies needed for disaster medicine surveyed physicians following a disaster response. Few reported a knowledge deficit. Instead, the transition from their usual environment to the practice in a disaster setting seemed to be the main challenge. Authors concluded that the clinical and procedural skills already incorporated into medical training are an adequate basis for disaster medicine. This conclusion may not be universally applicable: the study population was a convenience sampling of attendees at a disaster response conference, who presumably would have acquired knowledge outside of their usual training through activities such as attending disaster medicine conferences.

There is a veritable alphabet soup of short courses in life support: ACLS, ATLS, PALS, CALS, ALSO, etc. In addition, there are specific disaster courses: ADMR (Advanced Disaster Medical Response), CDLS, BDLS, and ADLS (Core, Basic, and Advanced Disaster Life Support, respectively). The former are useful to lay the foundation for clinical competence, the latter for extra-clinical aspects of disaster medicine. There is evidence in the literature that advanced life support training does improve clinical skills, including those used in disaster settings, though retention may diminish over time. Initial learning and retention appear to be increased for those with some clinical experience when compared to those who complete the course prior to their clinical training. The efficacy of the training varies with its format: video and face-to-face instruction result in comparable knowledge; both are superior to online computerized delivery of the educational material. The disaster life support courses may help ease the transition to practice in disaster settings by familiarizing the participant with characteristics of these settings and an all-hazard response. With certification courses, it is important to avoid “merit badge” mentality; merely completing the course does not imply competence, and absence of the wallet card does not imply lack of skills. These courses are training devices, not standards of care.

Disasters often disproportionately impact at-risk subpopulations, including pediatric, obstetric, elderly, disabled, and psychiatric patients. Family medicine training emphasizes specific care for all of these groups. By supplementing comprehensive family medicine training with disaster-specific topics, including chemical, biological, radiological, and nuclear (CBRN) incident response, the family physician can prepare for what they may encounter. In addition to formal courses, CBRN training resources include books and other printed materials, and audiovisual materials. There is insufficient evidence for the efficacy of self-study for disaster medicine training.

Rural and global health experiences during medical training are reported to improve clinical skills. Experience in these relatively austere environments promotes reliance upon clinical ability rather than on technology; the absence of readily available interventionalists forces development of procedural skills. Intuitively, these clinical rotations would seem to bear directly on easing the transition to disaster medicine noted above. The value of this type of training in disaster medicine would be a worthy topic of research.

Psychological First Aid Training
Perhaps the most controversial aspect of disaster training surrounds mental health. This is also the aspect of disaster medicine for which we found the largest amount of evidence in our review of the literature. The stress accompanying critical incidents can cause post-traumatic stress disorder (PTSD) in both victims and responders. The goal of early intervention is to prevent the traumatic experience from becoming chronic PTSD. The current literature on crisis intervention reveals differing points of view on the methods that should be used. Nevertheless, there is near universal endorsement of the value of acute psychological first aid (PSA), and evidence-informed competencies have been developed.

The essence of PSA is the belief that reducing disaster stress may best be accomplished through interventions designed to enhance resilience in psychologically healthy people. Training in PSA prepares responders to deal with personal stress experienced in critical incidents and to assist others. Though data is sparse for disaster mental health interventions in general, there is some evidence to suggest that both disaster victims and responders may benefit from group training in present-centered therapy, acute debriefing, and supportive, cognitive behavioral, and psychodynamic approaches. Resources for PSA training are available from the National Center for PTSD, the American Red Cross, and the International Critical Incident Stress Foundation (Table 3).

Conclusions
We have reviewed the literature for evidence of efficacy in training for the competencies identified in the Disaster Medicine Curriculum Guideline. The published evidence for improved outcomes for the majority of disaster preparedness, disaster response, and disaster medicine interventions is limited. Similarly, an evidence base of either educational or patient-oriented outcomes in support of disaster training in general, or of educational modalities for teaching specific competencies, is markedly deficient (Table 4). As disaster preparedness and training endeavors continue to be implemented, we call for further research in outcome-based disaster preparedness.
training. Surrogate endpoints are necessary, since disasters are difficult to study prospectively. Patient-oriented outcomes are difficult to correlate to training interventions. In addition, response training in teams is critical, making physician-specific training hard to assess. Perhaps in a future review of this topic, a good evidence base will exist that can be cited, allowing definitive recommendations to be set forth.

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