Training medical staff for pediatric disaster victims: A comparison of different teaching methods

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Abstract

Objective: *The goal of this study was to assess the effectiveness of the different types of healthcare worker training in pediatric disaster medicine knowledge over time and to analyze the effects of training type on healthcare workers' attitude toward pediatric disaster medicine.*

Design: *Prospective randomized controlled longitudinal study.*

Setting: *Large, urban, tertiary academic children's hospital.*

Subjects: *Physicians and nurses employed at Children's Hospital Los Angeles randomly selected from a global hospital e-mail server over a 3-week time frame were invited to participate and receive an incentive on completion. Forty-three controls and 42 intervention subjects (22 lecture + tabletop exercise, 20 lecture only) completed the study. Subjects with disaster training in the prior 6 months were excluded.*

Interventions: *Subjects underwent a didactic lecture or a combination of didactic lecture and tabletop exercise. Preintervention and postintervention testing took place using a 37-question multiple-choice test on pediatric disaster medical topics. Posttesting took place immediately after intervention and then 1, 3, and 6 months after the intervention. Subjects also were surveyed before and after intervention regarding their attitudes toward pediatric disaster medicine.*

Main outcome measures: *(1) Scores on a 37-question knowledge test and (2) Likert scores on self-perceptions of knowledge, comfort, and interest in pediatric disaster medicine.*

Results: *Regardless of intervention type, participant scores on a postintervention pediatric disaster medicine tests over a 6-month period increased and remained well above pretest means for intervention and control pretest scores. There were no differences in scores comparing type of intervention. However, subjects who underwent the tabletop simulation had a better sense of knowledge and comfort with the topics compared with those who only underwent a didactic lecture.*

Conclusions: *Didactic lecture and tabletop exercises both increase healthcare worker's knowledge of pediatric disaster medical topics. This knowledge seems to be retained for at least 6 months postintervention. The addition of the tabletop exercise to a standard didactic lecture may increase a learner's sense of knowledge and comfort with disaster topics, which may in turn lead to increased staff participation in the event of an actual disaster.*

Key words: disaster, training, child, education, teaching methods, healthcare workers

Introduction

A *disaster* is defined as an event in which victims' needs outstrip available resources. Because of this, healthcare workers (HCWs) not usually involved in emergency situations will likely be called on to act in the face of disaster. Knowledge of how to respond to a chemical, biological, radiological/nuclear, or explosive incident is essential for medical personnel from all fields that work in hospitals. HCW report low levels of competency and knowledge regarding bioterrorism and mass casualty topics; yet, they have high levels of interest in learning more.[1,2] A 2001 study by Treat et al.[3] assessing preparedness for weapons of mass destruction incidents found that "amongst hospital personnel, there appear to be significant gaps in knowledge and skill-content areas." As of 2002, only 10 percent of states in the United States required disaster training of medical professionals, and only half offered it.[4]

Although the literature offers little evidence-based information regarding disaster education of HCWs for the general public, even less is known about the ability of the healthcare system to respond to the youngest victims of disaster and terrorism. There is an evidence to suggest that they are at increased risk for poor outcomes because of their unique physical and psychological vulnerabilities.[5,6]

A comprehensive review of disaster education literature by Hsu et al.[7] in 2004 found a dearth of convincing data with regard to effectiveness of any type of mass casualty incident (MCI) training of HCWs. This is partially due to the heterogeneity of studies in the field and wide variability in methods to evaluate the effectiveness of drills, computer simulations, or tabletop exercises in training hospital staff to respond to an MCI. More than 150 different professional level courses that address the threats of terrorist action exist,[8] and none have been scientifically evaluated.

There is currently no widely accepted consensus on how to measure effectiveness of MCI training.[7,9] HCWs' ability to diagnose and manage bioterrorism incidents are insufficient and ineffective and is helped in the short term by didactic modules (eg, lectures, online modules, in-services),[10,11] but long-term retention of course content remains unknown. Hospitals most commonly prepare for mass casualty events by performing drills or by holding didactic teaching modules for staff or by a combination of both. Drills and tabletop exercises have been touted to reinforce knowledge of disaster plans and equipment, and improve patient tracking and flow,[7] but have not been studied as a method to learn factual information and clinical management of chemical, biological, radiological/nuclear, or explosive victims. Technology-based educational tools on MCIs have been reported to increase the healthcare provider's knowledge of injury treatment, improve information retention, and troubleshoot within the response system in a variety of clinical scenarios.[12-15] However, there are no data establishing the most effective method of learning and retaining disaster medical knowledge.

In response to the lack of controlled trials evaluating the efficacy of different training techniques, we designed a study to directly compare knowledge gained from a didactic lecture versus a combination of tabletop exercise and didactic lecture versus a control with no intervention. Secondary outcomes included an analysis of the rate of knowledge retention and effect of learning intervention type on attitudes towards pediatric disaster medicine.

Patients and methods

The Children's Hospital Los Angeles (CHLA) Disaster Education Study was a prospective, longitudinal pilot study conducted at CHLA. The principal aim was to evaluate the different methods of teaching pediatric disaster information to HCWs over time. We compared two methods of teaching between each other (didactic lecture versus didactic lecture + tabletop exercise) and with control subjects who had no intervention. We hypothesized that the combination of interventions will yield the highest level of learning of pediatric disaster knowledge in all time frames compared with the single intervention of didactic lecture, or no intervention (control), with the scores on testing waning over time for all groups. We anticipated that knowledge decay would be slower in the "lecture + tabletop" intervention group compared with the "lecture only" group.

Performance was also broken down by receiver type. We classified subjects into two groups: "expected first receivers" (EFRs) and "not-expected first receivers" (NEFRs). This categorization was intended to look at those staff members who deal with daily, unexpected public emergencies and are anticipated to be on the front lines of all types of disaster response and compare them with those who are less likely to be in this position. The EFRs included residents, float nurses, administrative, emergency, pediatric intensive care, and surgical staff. Participating departments from the NEFR category included staff from general pediatrics clinic and wards, radiology, neonatal intensive care, cardiothoracic intensive care, and subspecialty clinics (rheumatology, neurology, adolescent medicine, psychiatry, nephrology, cardiology, infectious disease, hematology/oncology, bone marrow transplant, pulmonology).

Development of intervention materials

Using recent peer-reviewed literature from what our team deemed reliable resources (peer-reviewed journal articles, practice guidelines, current textbook, and expert panel recommendations on pediatric disaster medicine), we designed a 45-minute didactic lecture discussing pediatric disaster management, with a focus on pediatric specific vulnerabilities, mass casualty triage strategies, decontamination, and a segment on explosive injury patterns.

In addition, we designed a tabletop scenario of an explosion incident at an elementary school designed to reinforce the concepts learned in the didactic lecture. The tabletop differed from typical tabletop exercises, as it focused on informational medical management and disaster medicine knowledge rather than traditional topics of disaster plan operations and patient flow issues.

Questions for testing the intervention were designed by the principal investigator and reviewed by the hospital's head of Division of Emergency Medicine, the head of Trauma Surgery, and an expert in the field of pediatric disaster medicine from an outside institution. Questions were based on the same resources from which lecture content was derived.

Subject selection

All subjects worked at the CHLA as medical doctors (MDs) and registered nurses (RNs). To maximize the variety of specialties and work areas represented, we used a novel selection process. A global list of all hospital MDs and RNs was obtained from the CHLA Department of Human Resources. Separate lists were kept for the doctors and the nurses. List members with dental degrees and doctorates without additional medical degrees were excluded from the list so as to keep the pool of subjects limited to those hospital workers who most likely provided immediate medical care in the event of a disaster. There is a role for these professionals in a disaster, but their expertise, in the opinion of this research team, lay outside the scope of the educational intent of this particular study. Any subject who had formal disaster training in the past 6 months prior to recruitment was excluded in an attempt to isolate the effects of the study interventions on pediatric disaster medicine knowledge levels.

Initially, a random sample of 100 RNs and 100 MDs were chosen. All randomization was done using the STATA version 9 program. Using an online survey service (www.surveymonkey.com), these random subjects were e-mailed invitations to participate in the study. Incentives were offered for participation in the intervention arms of the study. Nurses were also offered continuing education credits. After filling out pertinent demographic data, subjects were asked to participate in the study. Subjects consenting to participate in an intervention group signed up agreeing to be randomized into one of two intervention arms. They then took a 37-question pretest. If a subject would not agree to be in an intervention group, we offered a small incentive ($5 coffee card) if they would take the same pediatric disaster medicine pretest. These subjects would serve as controls. After the initial invitations were sent out, we randomly chose another group of 50 MDs and 50 RNs who were sent invitations every 4 days until the day of the study or until a maximum number of recruits was reached (Figure 1). We set a maximum number of recruits at 66 per intervention because of limited number of staff capable of leading tabletop sessions and space constraints.

Enrollment of subjects was conducted over a 3-week period from February 1, 2007, until February 21, 2007. We recruited subjects over a 3-week period to undergo pretesting on the topic of pediatric disaster medicine via online e-mail invitation. An incentive was offered as part of the recruitment process as described earlier. Intervention subjects were divided randomly into a "lecture only" group and a "lecture + tabletop" group on the day of the interventions after all subjects had arrived. These interventions were performed on one evening, with immediate posttesting. Follow-up testing was also performed online at 1, 3, and 6 months postintervention. Scores were calculated

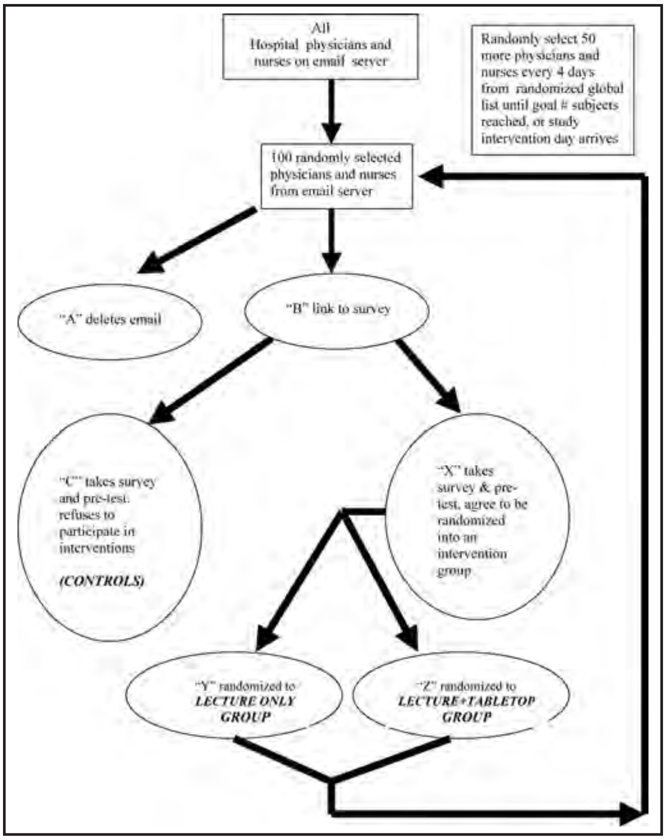


Figure 1. Subject selection method.

as a percentage of correct answers on a 37-question test designed by the team.

A total of 750 e-mails were sent out, with a 159 subjects responding over the 3-week period. Of 63 subjects who agreed to participate in the interventions, 43 subjects were present on intervention day and 20 were no-shows. Of the 43 study subjects, 22 were MDs (13 attendings, five fellows, and four residents), and 21 were nurses (19 RNs, and two nurse practitioners). Forty-three subjects completed the pretest and agreed to serve as controls including 31 doctors (19 attendings, six fellows, and six residents) and 12 nurses (two nurse practitioners, 10 RNs). Each of four randomly selected tabletop subgroups consisted of five to six subjects led by pediatric emergency medicine fellows trained by the principal investigator.

Statistical analysis

Dichotomous subject variables were compared using chi-squared test, and test score comparisons and Likert scale comparisons were done using student's t-test. Linear regression was performed to evaluate effect of unequal distribution of nurses in the combined lecture + tabletop group on group test scores.

Results

Forty-two of 43 intervention subjects and 43 controls completed the study. One lecture-only subject (a NEFRs attending level physician) dropped out because of inability to complete posttesting in a timely manner after the second posttest. Characteristics of the study subjects are summarized in Table 1. Mean pretest score on a 37-question pediatric disaster medicine knowledge test was 50.3 percent for controls and was not statistically different than the pretest means for intervention subjects (47.2 percent for the lecture group ($p = 0.23$), and 46.2 percent ($p = 0.15$) for the lecture + tabletop group). Among all categories of subject types, only job title (physician versus nurse) showed any pretest differences, with physicians outperforming nurses (see Table 2). Immediately after intervention, mean scores increased to 79.6 percent for the lecture-only group, and 80.3 percent for the lecture + tabletop group. There was no statistically significant difference between intervention types on immediate posttesting ($p = 0.77$), but there was a significant jump in scores from baseline The lecture-only group gained a mean 32.3 percent, and for the lecture + tabletop group gained a mean 34.3 percent compared with controls ($p < 0.0001$). One-, 3-, and 6-month postintervention testing showed expected drops in scores for both groups, but scores remained well above baseline (Graph 1). No difference in knowledge scores between intervention types was detected at any time frame. Knowledge was retained to a degree that there were no statistical differences detectable between the immediate and delayed (1, 3, and 6 month) posttest scores.

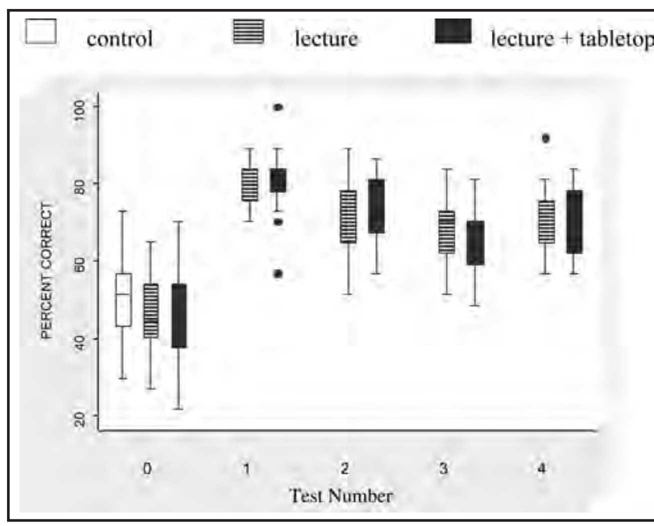
EFR's pretest scores were similar to NEFR (49.3 percent versus 46.2 percent, $p = 0.13$). Changes in posttest scores were not different for receiver types, and both groups remained well above their pretest scores (Graph 2). Immediately after intervention, EFRs gained an average of 32.8 percent in their scores, whereas NEFRs scored an average of 33.8 percent ($p = 0.74$).

Table 1. Subject profiles						
	Controls	**Intervention subjects (combined)**	**p**	**Lecture-only subjects**	**Lecture + tabletop subjects**	**p**
N	43	42		22	20	
Age (mean in years)*	38.3	38	0.92	39	37.7	0.80
Females (percent)*	64	79	0.17	66.7	90.9	0.05†
Physicians (percent)*	74	38	0.02†	66	36.4	0.06†
Expected first receivers percent)*	44	50	0.75	52.4	45.5	0.70
Pretest perceived knowledge (avg score)‡	2.3	2.4	0.44	2.3	2.5	0.84
Pretest perceived interest (avg score)‡	3.1	3.6	0.006†	3.5	3.6	0.96
Pretest perceived comfort (avg score)‡	2.3	2.4	0.25	2.4	2.4	0.73

Pretest scores are self-perceived ratings on a 1-5 Likert scale, with 1 being lowest, 5 highest.
*p calculated by chi-squared test.
†Statistically significant value.
‡p calculated by student's t-test.

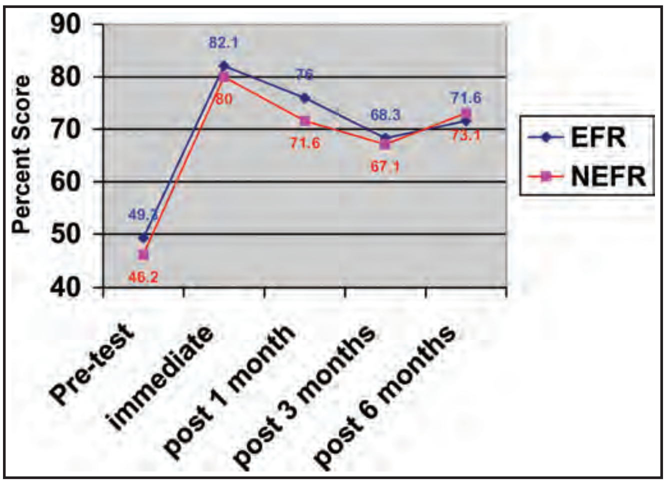
Table 2. Pretest scores on knowledge test by different subject categories		
Subject type	**Scores (percent)**	**p-value**
Males/females	50.0/47.9	0.41
Physicians/nurses	50.9/44.4	0.005*
EFRs/NEFRs	49.3/46.2	0.13
Control/intervention	50.3/46.7	0.12
Lecture/lecture + tabletop	47.2/46.2	0.65

EFR indicates expected first receiver; NEFR, not-expected first receiver.
*Statistically significant difference. p calculated using t-test.



Graph 1. Pretest and posttest scores. Baseline pretest scores (Test 0) for controls (solid white bar) for lecture only (striped bar) and lecture + tabletop (solid dark bar) groups were statistically similar. Immediate (posttest 1) and delayed posttesting (postintervention 1, 3, and 6 months corresponding to posttests 2, 3, and 4, respectively) showed an increase in knowledge that persisted well above pretest levels of knowledge. No difference between intervention types was detectable.

Thirty-seven of 42 (88 percent) intervention subjects completed a preintervention and immediate postintervention survey that asked questions to assess self-perceived interest, knowledge, and comfort with the material (Table 3). Pretest interest levels were clearly higher in the intervention subjects than among controls, but knowledge and comfort levels were similar among controls and interventions subjects (Table 1). Among the intervention subjects, only those who underwent both lecture and tabletop exercise reported a self-perceived increase in their knowledge (an increase from 2.50 to 3.05 on a five-point Likert scale) and comfort (a mean increase from 2.44 to 2.88) with the material. Interest in the subject material remained unchanged from pretest levels regardless of intervention type. Of the six subjects who did not complete the postintervention data, five were from the lecture + tabletop group and one was from the lecture-only group. Their pretest knowledge mean was 2.6, comfort was 2.5, and interest was 4.0, placing these subjects on par with the other subjects for preintervention scores for knowledge and comfort and slightly above the mean for interest.



Graph 2. Expected first receivers (EFR) test scores (blue) compared with not-expected first receivers (NEFR) scores (red). Pretest and posttest scores between the two groups were not statistically different at any time frame. Both groups attained scores that remained elevated above baseline after intervention. Intervention type did not affect the score.

Discussion

Our subjects, all pediatric practitioners, affirmed that their preintervention pediatric disaster medicine knowledge was low as measured by our pretest in among all groups of participants. We speculate that these levels of knowledge would be even lower at institutions that do not care for children on a regular basis. There was no significant difference in pretest scores between "EFRs" and "NEFRs," between males and females, between controls and intervention subjects, and between intervention types (Table 2). However, overall, and in our intervention groups, physicians had higher pretest scores than did nurses (50.9 percent versus 44.4 percent respectively, $p = 0.005$).

Table 3. Mean Likert Scale scores for attitudes about pediatric disaster medicine

	Preintervention			Postintervention		
	Control	**Lecture only**	**Lecture + tabletop**	**Control**	**Lecture only**	**Lecture + tabletop**
Knowledge	2.27	2.33	2.5	N/A	2.6 ($p = 0.17$)	3.05* ($p = 0.016$)
Interest	3.09	3.57	3.63	N/A	3.8 ($p = 0.13$)	3.76 ($p = 0.10$)
Comfort	2.27	2.42	2.41	N/A	2.65 ($p = 0.33$)	2.88* ($p = 0.004$)

A five-point rating scale (1 = lowest, 5 = highest) was used. Subjects completed a preintervention and postintervention survey that asked questions to assess self-perceived interest, knowledge, and comfort with the material. Controls did not do a postintervention survey since they had no intervention.
*Statistically significant difference between preintervention and postintervention value as determined by paired t-test.
N/A = not applicable.

A higher proportion of nurses agreed to participate as intervention subjects than did physicians, and more physicians participated as control subjects than nurses. Using linear regression analysis to take into account the disproportionately high nurse representation (and potential confounding effect) in the tabletop group, we still saw no significant difference between intervention type, but the p value dropped from 0.93 to 0.28. The coefficient predicted physicians to score 7.2 percent higher than nurses based on pretesting results. So, although raw posttest scores between intervention types appear to be almost equal, we would have expected the tabletop group to have lower scores because of the small number of physicians present in that intervention group. The lecture + tabletop intervention group did have proportionally more female members than controls and lecture-only intervention. This did not skew our results when we ran a multivariate analysis taking into account subject sex. Pretest scores were no different between the sexes, with males scoring an average of 50.0 percent and females scoring 47.9 percent ($p = 0.41$). Our interventions (lecture and lecture + tabletop experiences) raised scores that remained significantly above baseline out as far as 6 months after the interventions (Graph 1). We saw an equally high increase in scores among expected and not expected first responders, regardless of intervention type (Graph 2).

It is essential that our nonpediatric physicians become well versed in pediatric disaster care since the majority of emergency care received by children in the United States is carried out in facilities not dedicated to children.[16] Children represent a significant fraction of disaster victims, and medical staff overall feel less capable of caring for them. A 2007 study looking at four separate Disaster Medical Assistance Team (DMAT) deployments (a DMAT is a US federally run program that sends regional teams of HCWs to disaster sites) found that children younger than 17 years old made up 29.5 percent of all victims and 15 percent were less than 5 years old. Pediatric victims were 1.2 times more likely than adults to be categorized as red (immediate care) at the time of triage.[17] An Israeli study found emergency department staff had a lower perceived level of knowledge and skills to cope with a mass casualty event involving children than with adults.[18] So, with a high proportion of victims among a vulnerable population, are hospitals preparing to include them in their disaster planning? A recent survey on emergency preparedness showed that among surveyed emergency medicine and family practice programs, 40 percent stated they "never" include children in their drill scenarios, whereas another 53 percent only "sometimes" included pediatric victims.[19] Shirm et al.[20] reported that across the nation, only 13.3 percent of emergency medial service agencies have pediatric-specific emergency plans. A 2006 California Emergency Medical Services Authority pediatric disaster survey of local Emergency Medical Services Authority agencies, children's hospitals, personnel from the Offices of Emergency Services, county clinics, and other hospitals demonstrated that there are serious gaps in the statewide pediatric disaster plan, including training of medical personnel in pediatric specific triage, pediatric patient representation in drills, stabilization and treatment of pediatric patients, accessing additional pediatric medications, and how to obtain pediatric expert advice. They concluded that there was "a need for development and delivery of training on disaster response to pediatric patients, on a basic awareness level as well as more rigorous training for EMS and hospital personnel." They recommended that agencies encourage development of drills and exercises that include children and pediatric-related issues and develop procedures and templates for a variety of key response functions including field care for pediatric patients. They based these recommendations on training gap findings including the following: (1) more than 75 percent of the respondents reported that plans had neither no knowledge nor plans for pediatric triage algorithms or concepts; (2) only half of the agencies that had pediatric training included pediatric triage concepts; (3) training curriculum was variable with no uniform set of pediatric issues included; and (4) less than 20 percent of hospital staff had pediatric disaster training.[21] In 1999, a Pediatric Disaster Life Support class was developed, but it has not been widely adopted in the pediatric community thus far.[22]

Retention of pediatric disaster knowledge above baseline knowledge lasted to the 6-month goal.

However, is this didactic knowledge useful in a true disaster situation? Would it translate into more effective disaster response? The translation of disaster training into practical, effective response is one of the more challenging aspects of disaster medicine and difficult to measure. Obviously, disasters cannot be created for study prospectively, so one must rely on retrospective examination of disaster response or create models and drills to evaluate response capability. Models and drills do not effectively recreate levels of chaos experienced in true disasters and are also tainted by the awareness of key staff of their upcoming presence. A 2004 study looked at differences in preparedness as perceived by mock victims, participants, and drill observers during two separate drills—one drill date known ahead of time, the other unannounced. Participants did not know the scenario in either case. They found significantly higher levels of perceived preparedness and level of medical care received in the announced drill. These results imply that announced drills might instill a false sense of security in the disaster response plan that may not be present when a true disaster (almost always an unannounced event) strikes.[23] Our group at CHLA, the Pediatric Disaster Resource and Training Center, is currently working to bridge this gap in pediatric disaster medicine knowledge via a creation of a pediatric disaster educational curriculum that will include a variety of teaching strategies, ranging from computer modules, didactics, drills, and computer-based simulations.

Factual knowledge of the disaster response is only one important component of an ideal first receiver's development. We propose that an HCW will be present and competently able to participate in a disaster if they have the following traits: (1) proper training and/or experience, (2) a willingness to participate, and (3) the proper infrastructure that allows them to be available to partake in the incident. Qureshi[24] proposed that to have an HCW available to respond to a disaster, that person must first be both willing and able to participate. Willingness to respond to a disaster is not always a given. Qureshi found that HCWs were less willing to respond to disasters perceived as a threat to self or family. In a national survey of pediatric surgeons on disaster preparedness, our group found that feeling "personally prepared" for a disaster was associated with a 3.33-fold increased willingness to respond to a disaster situation.[25] In our current study, we saw an increased sense of self-perceived knowledge and comfort with the topics in those who participated in the tabletop exercise compared with those who only had the lecture intervention. A feeling of having adequate knowledge and comfort with disaster topics may lead to an increase in willingness by an HCW to actively participate in an actual disaster. So, despite no difference in terms of knowledge gained based on learning method, the HCWs who underwent the tabletop exercise felt they had learned more and would possibly be more likely to respond as a first receiver in the event of a true disaster.

Controversy exists as to how best define, let alone measure, "preparedness." A 2005 study from RAND corporation reviewed 27 different instruments used to plan or evaluate "preparedness" found that most "had a significant amount of overlap, but little consistency in what constitutes 'preparedness' or how it should be measured." They concluded that standardization of measurements, more interagency communication, and investment in developing the evidence to develop quality measures and assessments was needed.[26] We recommend establishment of a set of core competencies based on available evidence-based literature and expert opinion in pediatric disaster medicine. From this, test questions about terminal objectives could be formulated. Several different models[27-30] for disaster medicine educational competencies have been proposed; however, most lack measurable objectives, and none address specifically the needs of pediatric patients. Evidence-based national guideline standards for preparing for, responding to, and managing pediatric terrorism victims have been published,[31] but pediatric competencies have not yet been derived from them. Hsu and colleagues[32] from Johns Hopkins and Loma Linda have devised one model that may be applicable to the development of measurable pediatric disaster medicine competencies. They suggest a set of seven basic disaster competencies that "cross-cut" across different fields in healthcare. Examples of how pediatric victims might present unique challenges within this model (the Johns Hopkins Critical Event Preparedness and Response (CEPAR) Cross-Cutting

Table 4. Sample pediatric applications of basic disaster competencies	
Johns Hopkins CEPAR Cross-Cutting Competencies[12]	**Example of special consideration for MCI involving children**
1. Recognize potential critical events and implement actions	Mass casualty event near a school or daycare may require contact of nearest children's hospital for mobilization of extra pediatric sized equipment
2. Apply principles of critical event management	Address strategies for reunification of children with families. Ensure staging areas have child safety measures employed.
3. Demonstrate critical event safety principles	Issues of separation of parent/child dyads leading to security threat, psychological aspects of children that may make them unable to or unaware of how to follow safety precautions
4. Understand institutional emergency operations plans	Knowledge if home institution has surge capacity capability for influx of large numbers of pediatric victims, or prearranged plan with nearby children's hospital for transfer of victims or equipment
5. Demonstrate effective communication	Communicate with nearest children's hospital to arrange transport of pediatric victims (if feasible). Prearrange consultation to be available for nonpediatric facilities to obtain pediatric specialty advice from pediatric disaster/emergency specialists. Communicate with pediatric patients using age appropriate language
6. Understand Incident Command system	Include pediatric considerations into job action sheets (eg, nutritional supply leader has access to formula and bottles)
7. Demonstrate knowledge and skills to fulfill individual role	Triage using pediatric guidelines, decontamination of children using warm water, estimation of weight, pediatric dosing of medications and fluids.

Competencies) are presented in Table 4. Training designers may take these basic principles and tailor them to their specific trainee group (in our case to pediatric care providers). Standardization of terminology and agreement on vital content in pediatric disaster medicine will be an important step in defining what components a competent pediatric first receiver must have in place to ensure a competent response to disasters involving children.

Limitations of this study

Even though our initial selection was randomized, some selection bias still exists as our subjects had to agree to participate in the study. However, from our demographic data, we see a wide variety of specialties and work settings were represented and we hold that our sample included a group of subjects was not limited to the traditional first line of expected responders (emergency department, intensive care, and surgery staff) to an MCI. Our study reached out to those practitioners who might be called on in such a situation when victim needs outstripped the usual emergency resources. One objective of the incentive was to capture a group of HCWs that would not normally have a vested interest in disaster medicine, and this aim was accomplished.

We did have a significant number of no-shows (21 of 63 intervention subjects) on intervention day. Analysis of these subject's pretest data showed they had a similar profile to our subjects who did participate (no-show mean pretest score: 44.5 percent, pretest perceived knowledge: 2.3, comfort: 2.6), which can be seen by comparing the values for intervention subjects in Table 1 and Graph 1. The exception to this, ironically, was that "no-shows" had a higher interest level than any other subject group (self-perceived interest: 4.0).

Another limitation is that we had no control of our subject's use of outside reference material and other educational interventions that may have occurred during the follow-up testing period. There may also have been a degree of a learning bias, as subjects may have learned the specific information required for them to excel at this particular knowledge test on pediatric disaster medicine. To minimize this bias, two different versions of the test were created and alternated between testing periods. It would have been helpful to retest the control subjects at similarly timed intervals after intervention day to be able to measure the effects of outside resources leading to learning of pediatric disaster medicine among our subjects.

Our test has not been formally validated as a learning tool on the subject of pediatric disaster medicine. To establish a validated tool, we would need a series of pilots of this group of test questions. The test was designed by physicians and perhaps unfairly biased questions against nurses and their fund of knowledge, resulting in lower scores among that group of subjects. Our results may only be applicable to pediatric practitioners. Care should be taken when extrapolating these results to include nonpediatric care providers.

Conclusions

Both our didactic lectures and tabletop exercise were effective means of transmitting educational information on pediatric disaster medicine to pediatric HCWs that lasts at least 6 months postintervention. The addition of the tabletop exercise to the lecture did not change the overall knowledge scores but did impart a sense of increased self-perceived sense of comfort and knowledge of the information among participants. Future studies should investigate if these interventions are as long lasting and effective in nonpediatric trained HCWs. A standardized set of pediatric disaster competencies should be established to allow for a measurable, replicable experiment to be performed and for the community at large to have the ability to discuss disaster medicine topics with a common terminology.

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