Training program for pharmacists in pediatric emergencies

LORI SMALL, ANGELA SCHUMAN, AND PAMELA D. REITER

Problem
Pharmacists specializing in pediatric practice are expected to maintain the skills and clinical judgment necessary to participate in the resuscitation of a critically ill child. The Children’s Hospital (TCH) in Denver, Colorado, mandates completion of a pediatric advanced life support (PALS) course for all medical residents and routinely conducts simulated emergency-resuscitation events for these physicians. However, these activities are not intended to train the pharmacy staff to handle predefined roles and responsibilities in a pediatric emergency. At present, only a few pharmacists at TCH are certified in PALS, and even fewer are routinely involved in the care of pediatric patients requiring resuscitation due to trauma or respiratory or cardiovascular collapse. Since a pharmacist is a vital member of the emergency response team at TCH, we felt that all pharmacists should be competent in emergency management.

This article describes a training program that includes a computer-based clinical competency module and mock emergency-resuscitation events for improving the confidence and skills of pharmacists participating in pediatric emergencies.

Purpose. A training program for improving the confidence and skills of pharmacists responding to pediatric emergencies is described.

Summary. Pharmacists at a pediatric teaching hospital were asked to voluntarily participate in a training program in pediatric emergencies. The program consisted of two educational interventions. The first intervention was a 30-minute self-study, audiovisual, computer-based module incorporating accepted guidelines for pediatric emergency care. The second intervention was participation in an objective structured clinical evaluation designed as two simulated emergency-resuscitation events allowing for experience, feedback, and evaluation in four major areas: time spent performing required tasks, identifying and locating emergency equipment and medications, drug preparation and administration, and recognition of potential complications. The pharmacists’ confidence and skills were assessed before and after the program. Nineteen pharmacists participated in the program; more than half of them had had no experience in an actual pediatric emergency during the preceding six months. After the training was completed, confidence levels (assessed by written questionnaire) increased by an average of 14.5%; the increase was significant for four of the five questions. Competency (evaluated by a 20-item examination) increased by an average of 11% (p < 0.001).

Conclusion. A training program in pediatric emergencies for pharmacists appeared to increase their confidence and competency for responding to these events.

Index terms: Education, pharmaceutical; Emergencies; Pediatrics; Pharmaceutical services; Pharmacists, hospital; Professional competence; Protocols

Am J Health-Syst Pharm. 2008; 65:649-54

Background
The use of simulated emergency-resuscitation events to improve the clinical preparedness of nurses and physicians for pediatric and adult emergencies has been previously reported, yet a formal evaluation of such training for pharmacists has not been published to date. TCH is a private, nonprofit, level I regional trauma center serving a multistate area. The emergency response team at TCH responds to an average of 36 emergency-resuscitation events (cardiac or respiratory arrests on the...
wards) and 97 traumas (ambulance or helicopter arrivals to the emergency department) per year. Additionally, there are numerous resuscitation efforts for patients in the pediatric intensive care unit (PICU), neonatal intensive care unit (ICU), and cardiac ICU that do not involve the emergency response team but are attended to by the respective ICU teams. The core members of the emergency response team include the most senior members of each specialty available in the hospital on a 24-hour basis. The team comprises trauma physicians, anesthesiologists, emergency department nurses, intensive care fellows, neurosurgeons, respiratory therapists, and a pharmacist.

**Analysis and resolution**

Since 2005, the pharmacy department has used self-study, computer-based learning modules to assess and record clinical competencies in a variety of pharmacy areas. We developed and assessed a training program in pediatric emergencies for pharmacists that includes a computer-based learning module and participation in simulated emergency-resuscitation events.

This prospective, observational, educational, interventional exercise was reviewed and approved by the institutional review board. Pharmacists employed by TCH on a full-time basis were asked (through e-mail or direct contact) to voluntarily participate by one of the investigators. Consent for participation was obtained after each pharmacist read an information sheet and had the opportunity to ask questions. To deidentify participants, pharmacists were assigned a program number and were asked to complete a questionnaire that assessed their education, pharmacy experience, and past participation in pediatric emergencies. The pharmacists then completed a five-item survey to measure baseline confidence regarding participation in a pediatric emergency. Confidence was rated on a 4-point Likert scale (1 = no confidence, 2 = somewhat confident, 3 = confident, and 4 = highly confident). We chose a 4-point rather than a 5-point scale to avoid central-tendency bias. The pharmacists rated their confidence in ability to provide medications during a trauma or emergency-resuscitation event, ability to predict and anticipate medication requirements during a trauma or emergency-resuscitation event, and ability to locate medications and supplies during a trauma or emergency-resuscitation event. The pharmacists also completed a 20-item test of baseline clinical knowledge in operational and medication-related topics (appendix).

Within one week of completing the baseline confidence survey and competency test, the pharmacists participated in the training program, which consisted of two educational interventions. The first intervention was a 30-minute, self-study, audiovisual, computer-based module designed and produced by the investigators and incorporating both local and nationally accepted guidelines for pediatric emergency care. The module focused on the pharmacist’s role in an emergency: emergency medication location and preparation, and common pediatric emergencies and their pharmacologic treatment; pictures were presented of emergency equipment, medications, equipment storage sites, and trauma care bays at TCH. The second educational intervention was participation in an objective structured clinical evaluation (OSCE) designed as two simulated emergency-resuscitation events. Feedback consisted of standardized information that covered key concepts. Preprinted evaluation forms were used to score proficiency with a rubric scoring system. The OSCE evaluated 11 distinct tasks during the simulated events. Each task was assigned a numerical value and was evaluated by all three investigators. The mean score for each task was based on input from all three investigators. A 19-point total score was possible. Within 48 hours after completing the training program, the participants were retested on their clinical knowledge (with the same 20-item multiple-choice examination) and were surveyed again to assess their confidence.

Each participant served as his or her own control. Responses to the confidence survey were treated as numerical data and were analyzed by using Student’s t test for paired data. Each response was treated separately, and responses were summed to create a group score for each question. A two-tailed Student’s t test was used to compare competency scores before and after.
the training. The a priori level of significance was 0.05. Descriptive statistics (mean or median ± S.D., when appropriate) were applied to the OSCE scores.

A total of 19 pharmacists participated in the program, or 100% of the targeted population. Pharmacy experience (defined as time spent practicing as a licensed pharmacist) ranged from less than 2 years to more than 10 years. Ten (53%) of the pharmacists had practiced for more than 10 years, and 14 (74%) had practiced specifically at TCH for 2–10 years. Nine (46%) had not completed a pharmacy practice residency. Eight (42%) had completed a 1-year postgraduate residency program, and 2 (10%) had completed a 2-year postgraduate program (a 1-year residency in general pediatric pharmacy followed by a 1-year subspecialty program).

More than half of the pharmacists (10 [53%]) had had no experience in an actual pediatric emergency during the preceding six months, whereas 5 (26%) (all ICU pharmacists) had participated in more than five. Thirteen pharmacists (69%) had completed a PALS program, with seven of them completing this program more than three years earlier, two within the preceding year, and four within the preceding two years.

Mean ± S.D. baseline self-reported confidence scores ranged from 2.3 ± 1.1 to 3.3 ± 1.09, depending on the question (Table 1). After the training program, mean confidence scores increased by 14.5% across all questions. A significant increase in confidence was detected for four of the five questions.

Overall OSCE scores for the 11 distinct tasks performed during the simulated resuscitation events ranged from 47% to 100%. The highest scores were associated with medication preparation, drug information, and anticipation of medication requirements (Table 2). The lowest scores were associated with the proper location of medications and supplies.

Mean ± S.D. baseline competency scores were 83.7% ± 16.9% (range, 35–100%). Competency scores increased by an average of 11% after the training program ($p < 0.001$). Among the seven pharmacists who scored less than 80% on the preintervention competency test, there was a mean increase of 23.5% in postintervention competency scores. Two of these seven participants had completed a residency, five had not been part of the team during an actual pediatric emergency within the

| Table 1. Pharmacists’ Confidence in Abilities during Pediatric Emergencies ($n = 19$)* |
|-----------------------------------------------|------------------------------|------------------------------|
| Ability                                      | Before Training Program      | After Training Program       |
| Provision of basic medications during trauma in emergency department | 3.3 ± 1.09                  | 3.6 ± 0.77                   |
| Provision of basic medications during emergency-resuscitation event on hospital ward | 3.2 ± 1.1                   | 3.6 ± 0.68*                 |
| Anticipation and prediction of medications needed during trauma in emergency department | 2.4 ± 1.12                  | 3.0 ± 0.78*                 |
| Anticipation and prediction of medications needed during emergency-resuscitation event on hospital ward | 2.3 ± 1.1                   | 3.0 ± 0.82*                 |
| Location of medications and supplies during pediatric emergency | 2.8 ± 1.1                   | 3.5 ± 0.69*                 |

*Responses were based on a 4-point Likert scale, where 1 = not confident, 2 = somewhat confident, 3 = confident, and 4 = highly confident.

$p < 0.05$ for the difference before and after the program.

$p < 0.001$.

| Table 2. Pharmacists’ Competency during Simulated Pediatric Emergency Resuscitation ($n = 19$)* |
|-----------------------------------------------|------------------------------|------------------------------|
| Task                                         | No. Points Possible | Mean ± S.D. Score |
| Signed attendance record                     | 1                           | 1.00 ± 0.00               |
| Located supplies                             | 2                           | 0.94 ± 0.23               |
| Identified offsite medications               | 2                           | 0.97 ± 0.10               |
| Prepared medications correctly              | 4                           | 3.60 ± 0.49               |
| Used needleless system                       | 1                           | 0.74 ± 0.45               |
| Anticipated medication use                   | 1                           | 0.95 ± 0.23               |
| Labeled all medications correctly           | 4                           | 3.60 ± 0.96               |
| Prepared 0.9% sodium chloride flush solution or delegated task | 1                       | 0.92 ± 0.25               |
| Asked questions                              | 1                           | 0.87 ± 0.32               |
| Provided correct information on medication administration | 1                       | 0.79 ± 0.38               |
| Prepared medication in a timely manner       | 1                           | 0.79 ± 0.42               |

*Pharmacists were evaluated by the investigators using the objective structured clinical evaluation method.
of any published studies evaluating this type of educational approach. Participation in mock emergency-resuscitation events has been evaluated previously. When medical house staff, nurses, and office-based primary care pediatricians participated in such exercises, their self-reported confidence and performance improved.\textsuperscript{1-3,5,6} In a survey, internal medicine residents reported that simulated events followed by debriefing sessions provided the most effective training in emergency resuscitation.\textsuperscript{11} Toma et al.\textsuperscript{12} reported that 30\% of pharmacy residency programs responding to a survey required pharmacy residents to participate in cardiopulmonary resuscitation. A majority of these residency programs provided special training tailored to the hospital.

We used an OSCE to assess pharmacist performance during the mock emergency-resuscitation events. OSCEs have been previously used to assess the performance of medical students and have been shown to be reliable, valid, and objective.\textsuperscript{13-15} OSCEs have also proven to be valuable for promoting student learning.\textsuperscript{16} The investigators acted as emergency-resuscitation event facilitators, because research has shown that experienced practitioners (acting as clinical facilitators) can have a positive influence on both the learning and evaluative phases of simulated events.\textsuperscript{17} Overall, the pharmacists performed very well in medication preparation and provision of accurate drug information. The lowest performance scores were observed for locating medications and supplies.

We used preintervention and postintervention test scores, along with a confidence survey, to evaluate the program’s impact. Pharmacists with the greatest improvement in confidence and competency were those with the least experience in responding to pediatric emergencies and those who scored lowest on the preintervention competency test. On the basis of direct feedback, we believe that participation in the mock events contributed substantially to the improvement in confidence. The highest confidence and competency scores were observed in pharmacists who had previously responded to pediatric emergencies.

Our experience involved only one institution and may not be applicable to all inpatient hospital settings. Additionally, the training program is time-consuming and requires a dedicated staff. While we requested that program participants work independently and not prepare prior to the baseline tests, we cannot rule out the possibility that advance preparation occurred. Last, since we used the same 20-item test to measure competency before and after the intervention, there was a possibility for recall bias. However, the correct responses were not revealed to participants until after the program.

Videotaped recordings of the OSCE allowed the investigators to evaluate the pharmacists’ performance without bias while adding realistic elements of pressure and anxiety to the mock events. We also provided immediate constructive feedback to participants after the OSCE. This debriefing session allowed for individualized teaching about key concepts.

We plan to conduct this training program annually and to require all TCH pharmacists to be competent in these skills. We have been asked to run simulated emergency-resuscitation events once per quarter for the pharmacy staff and to develop pocket information cards that list pediatric emergency medications and dosages.

Conclusion

A training program in pediatric emergencies for pharmacists appeared to increase their confidence and competency for responding to these events.
References


14. When selecting medications for a pediatric patient with head trauma, it is best to avoid medications that a. Decrease intracranial pressure. b. Increase intracranial pressure. c. Do not change pupils in response to light. d. Increase systemic arterial blood pressure.


17. All of the following statements about atropine are true, except
   a. The minimum dose is 0.1 mg (1 mL).
   b. It can be used for bradycardia.
   c. It can be used for rapid-sequence intubation.
   d. None of the above (all statements are true).

18. What is considered first-line therapy for a child in shock?
   a. Volume (normal saline).
   b. Dopamine 10 μg/kg/min.
   c. Dobutamine 10 μg/kg/min.
   d. Epinephrine 0.1 μg/kg/min.

19. When preparing medications for use during rapid-sequence intubation, what is the best order of administration?
   b. Sedative, neuromuscular blocker, analgesic, atropine.
   c. Neuromuscular blocker, analgesic, atropine, sedative.
   d. Sedative, analgesic, atropine, neuromuscular blocker.

20. Sodium bicarbonate is an appropriate treatment for all of the following indications except
   a. Respiratory alkalosis.
   b. Metabolic acidosis.
   c. Tricyclic antidepressant overdose.
   d. Hyperkalemia.

Copyright of American Journal of Health-System Pharmacy is the property of American Society of Health System Pharmacists and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.