Best Educational Practices in Pediatric Emergency Medicine During Emergency Medicine Residency Training: Guiding Principles and Expert Recommendations

Robert L. Cloutier, MD, Jennifer D. H. Walthall, MD, Colette C. Mull, MD, Michele M. Nypaver, MD, and Jill M. Baren, MD, MBE

Abstract

The state of pediatric emergency medicine (PEM) education within emergency medicine (EM) residency programs is reviewed and discussed in the context of shifting practice environments and new demands for a greater focus on the availability and quality of PEM services. The rapid growth of PEM within pediatrics has altered the EM practice landscape with regard to PEM. The authors evaluate the composition, quantity, and quality of PEM training in EM residency programs, with close attention paid to the challenges facing programs. A set of best practices is presented as a framework for discussion of future PEM training that would increase the yield and relevance of knowledge and experiences within the constraints of 3- and 4-year residencies. Innovative educational modalities are discussed, as well as the role of simulation and pediatric-specific patient safety education. Finally, barriers to PEM fellowship training among EM residency graduates are discussed in light of the shortage of practitioners from this training pathway and in recognition of the ongoing importance of the EM voice in PEM.

ACADEMIC EMERGENCY MEDICINE 2010; 17:S104–S113

Keywords: pediatric emergency medicine, guidelines, emergency medicine, residency, teaching

The Council of Emergency Medicine Residency Directors (CORD) Academic Assembly held in Orlando, Florida, in March 2010 provided a venue for emergency medicine (EM) educators to examine the state of pediatric emergency medicine (PEM) education and training within U.S. EM residency programs. The Academic Assembly planning committee invited the authors to develop a proposal for a presentation on the best educational practices for PEM within EM residency programs. The best practices recommendations were derived through a series of conference calls leading up to the presentation. The senior author (JB) developed a preliminary set of questions and best practice recommendations based on 15 years of work teaching PEM to EM residents and based on research of the PEM educational process. These were refined and revised during subsequent discussions with the remaining authors and evolved to the final set of recommendations, which were discussed during a postpresentation conference call. Comments from the session attendees were incorporated into the final set of best practice recommendations, which appear in this article. A comprehensive literature search was performed to provide material on which to base our recommendations. Overall, this article reflects the proceedings of the CORD Academic Assembly session; to enhance the discussion of best educational practices, the authors also offer expert opinion on the closely related issues of optimizing PEM education in the future, the promotion of PEM fellowship training within the specialty of EM, and PEM workforce issues.

All five authors have considerable experience (average 14 years, range 5–20 years) in teaching PEM, developing curricula, and administrating large PEM educational programs. Four are PEM fellowship-trained, two with EM residency training (JB, RC) and two with pediatric

From the Departments of Emergency Medicine, Oregon Health and Science University (RLC), Portland, OR; the Indiana University School of Medicine (JDHW), Indianapolis, IN; the Drexel University College of Medicine (CCM), Philadelphia, PA; the University of Michigan Medical School (MMN), Ann Arbor MI; and the University of Pennsylvania School of Medicine (JMB), Philadelphia, PA.

Received April 23, 2010; revisions received July 9 and July 11, 2010; accepted July 11, 2010.

Disclosures: The authors have no disclosures or conflicts of interest to report.

Supervising Editor: John Burton, MD.

Address for correspondence and reprints: Robert L. Cloutier, MD; e-mail: cloutier@ohsu.edu.

ISSN 1069-6563
PII ISSN 1069-6563583

doi: 10.1111/j.1553-2712.2010.00893.x

residency training (MN, CM), and are board-certified in PEM. The fifth author (JW) completed a combined EM and pediatrics residency and is board-certified in both specialties. Two authors are PEM fellowship directors (CM, MN), and two are directors of PEM education within EM residencies (JB, JW). One author is a director of a PEM simulation program (RC), and one is an associate program director for an EM residency (JW).

The 2006 Institute of Medicine (IOM) report *The Future of Emergency Care in the United States Health System* included a special focus, ''Emergency Care for Children: Growing Pains,''[1] setting the stage for the specialty of EM to reevaluate its role in the care of children. With the growth of PEM as a discreet field with a dual pathway to certification via either pediatrics or EM, a number of questions arise, such as: 1) what role does the specialty of PEM have within the larger EM community and are we fulfilling our mission with regard to the emergent care of children; 2) are EM residency programs successfully training the next generation of emergency physicians (EPs) to care for children; and 3) what are the future directions for PEM within EM in terms of a) encouraging PEM fellowship training and b) identifying a set of best practices for resident education.

In the United States, some parents or guardians can choose the emergency care setting where their ill or injured children will be evaluated. For others, directed by emergency medical services (EMS), site of care is determined by local, regional, or state EMS regulations. Settings offering urgent and/or emergent care for children include general urgent care facilities, general emergency departments (EDs), pediatric emergency departments (PEDs) embedded within general hospitals, urgent care facilities in children's hospitals, and EDs in children's hospitals. The most recent data on the number of U.S. ED visits per year, by age, was collected through the 2006 National Hospital Ambulatory Medical Care Survey, the longest continuously running nationally representative survey of hospital ED utilization.[2] It revealed that up to 18% (21,876,000 children) of all U.S. ED visits are by children less than 15 years old. Depending on a cutoff age of 18 years versus 21 years, pediatric patients make up approximately 20% of a general hospital's ED population. The same survey demonstrated that the majority of pediatric emergency care (PEC) visits occur in the ED of a general hospital.[2] For example, approximately three-quarters of infant ED visits in 2006 took place in EDs of general hospitals, whereas only 14% and 9% of these children were cared for in EDs of children's hospitals and PEDs of general hospitals, respectively.[2]

Training and experience of physicians in PEC settings varies considerably. PEC providers in general hospital EDs are typically EPs, and less commonly PEM physicians, while PEC providers in PEDs embedded within general hospitals are typically pediatricians, PEM physicians, and less commonly EPs. In EDs in children's hospitals, the majority of the providers are PEM physicians. Provider training can be limited to residency training in EM and/or pediatrics or can be augmented by a fellowship in PEM following residency. Thus, there is substantial variability in the PEM training and experience of providers caring for the majority of children.

With the majority of PEC specialists working in the minority of locations frequented by sick and injured children, the training of EPs in PEM must remain a high-priority educational focus within EM residency training. Maintaining an evidence-based practice standard for the acute care of children requires diligent and ongoing attention to PEM education during EM residency and beyond.

The Accreditation Council for Graduate Medical Education (ACGME) requires that four of 36 months of EM residency be spent caring for infants and children, or one-ninth of the EM resident's total training.[3] The alternative that the ACGME offers is that 16% of all ED encounters must occur in a PEM setting (1-month rotation roughly equal to 4% of patients).[3] If a residency program cannot provide enough pediatric patient exposure within a PEM setting, the ACGME requires that the difference be offset by the addition of non–ED-based pediatric rotations. Furthermore, the EM resident's pediatric experience should include time spent in the critical care of children, with more than 50% of the 4 months to be spent in an ED setting. The advantages of the ACGME requirements for EM residencies are that they provide programs with flexibility to construct a PEM curriculum adapted to their particular institution's or affiliate's resources. Additionally, EM residency program directors can fashion the PEM experience with a combination of ED time and a variety of supplemental pediatric rotations. The disadvantage of these requirements is the limited time available to teach (and learn) PEM core content and procedural skills (procedural opportunities typically limited in number) within the 4 of 36 months or one-ninth of the residency training period. The resident's PEM experience therefore is at risk of becoming diluted, and one can surmise that skill and information retention may be a problem. The flexibility and adaptability of the requirements create substantial variability in training experiences, thereby potentially creating an uneven pediatric knowledge base among EM practitioners.

EDUCATIONAL AND TRAINING CHALLENGES

Data from existing literature can help identify successes, deficiencies, barriers, and challenges with regard to the quality and quantity of PEM rotational experiences. Although few in number, these studies document specific deficiencies in training and identify areas where potential improvements could be made with just minor adjustments in clinical and didactic exposures.

One of the first efforts to define PEM education within EM training programs was undertaken by the Society for Academic Emergency Medicine PEM training task force in 1995–1996. With this charge, the task force conducted a survey of 118 EM residency program directors and collected data on program characteristics, the number and type of pediatric rotations, and other educational methods used to satisfy ACGME requirements.[4] Results showed that EM programs offered an average of 17 weeks of PEM rotations. Training sites

Table 1
Required Pediatric Rotations Among EM Residency Programs

Required Rotation	Percentage of Programs (n = 111)	Duration (Weeks)
PEM	85	12 (IQR = 5–16)
PICU	80	4 (IQR = 4–4)
Pediatric ward	49	4 (IQR = 4–4)
Pediatric outpatient clinics	29	4 (IQR = 4–4)
Urgent care	17	4 (IQR = 4–4)
EMS for		
Children	10	10 (IQR = 8–11)
Pediatric transport	10	2 (IQR = 1.5–6)
Step-down nursery	6	4 (IQR = 2–4)

IQR = interquartile range; PEM = pediatric emergency medicine; PICU = pediatric intensive care unit.

varied, with 80% of the training experiences based at a tertiary pediatric center, of which 77% had a pediatric residency and 27% a PEM fellowship.[4] Most programs used one (38%) or two (47%) facilities for PEM training, while several used three (15%). The types of facilities used were a general ED (53%), designated PED (40%), combined ED (7%), exclusive children's hospital ED (7%), or urgent care clinic (16%). The required pediatric rotations for EM residents are shown in Table 1. Other required rotations that were not exclusively pediatric included anesthesia, neurosurgery, toxicology, orthopedics, and trauma surgery. Seventy-five percent of programs offered one to five electives.[4]

In the majority of programs, EM faculty developed the accompanying PEM curricula, which included core lectures, grand rounds, and morbidity and mortality conferences. Pediatric advanced life support training for residents was required by 78% of programs, and advanced pediatric life support by 17%. PEM-trained faculty were the primary faculty engaged in teaching PEM in 67% of the programs, while 95% of programs had some presence of PEM-trained faculty.[4]

Although more than a decade old, collectively these data present a picture of the PEM training landscape within our specialty, and there are several important implications to be gleaned.[5] In many instances ACGME requirements were not only met, but exceeded, indicating that program directors highly prioritized the PEM aspects of their curricula. In other instances, there were obvious missed experiences, such as in the care of newborns and critically ill neonates. This may have been related to time constraints and availability of specific training venues. In the authors' opinion, the data suggest bias against teaching PEM in general EM departments. The educational and clinical backgrounds of faculty are critical factors for trainees' perceptions of the quality of their experiences; the fact most PEM was taught at another facility by a different set of faculty may contribute to an overall impression that 1) PEM is a less important part of general EM training or 2) their home faculty are not qualified and only PEM specialists ultimately should care for children. These conclusions, however, represent the opinions of the authors' and whether or not these were the perception of residents cannot be substantiated.

Aggregate data such as that gathered from the study by Tamariz et al.[4] above is limited in its ability to provide a deeper understanding of the quality of PEM experiences for individual residents. A prospective observational study of EM resident–patient encounters during a PEM rotation at a tertiary care children's hospital ED addressed this issue.[6] This study followed 56 EM residents who represented 20% of the total resident workforce for the year. Residents evaluated an average of 61 patients per rotation, working 14–18 shifts over a 3- to 4-week period. Sixteen percent of the patients seen by EM residents were admitted; the overall admission rate from the study ED was 20%. The mean (±SD) age of patients seen by EM residents was 6.3 (±5.6) years, and about 50% of the patients had complaints that fell into three diagnostic categories: ambulatory infectious disease (e.g., otitis media, pharyngitis), respiratory illness (e.g., asthma, pneumonia), and wound management (e.g. laceration repair, minor burn). Only 34% of EM resident–patient encounters involved laboratory data interpretation, 25% required diagnostic imaging interpretation, and only 2% ECG interpretation. EM residents led only five medical resuscitations, four trauma resuscitations, and 17 comprehensive child abuse evaluations during the study. The 56 residents performed 369 procedures over the study period, with laceration repair (170) and splint placement (72) accounting for the vast majority.[6]

In our opinion, these data raise strong concerns that EM residents rotating at a tertiary care, high-volume PED may have insufficient exposure to high-acuity pediatric patients that require complex decision-making and may have insufficient opportunity to learn and perform complex, life-saving procedures. The results invite speculation as to why the EM residents saw low numbers of acutely ill patients, performed few procedures, and disproportionately managed older patients. Faculty preceptors may have preferentially steered EM residents toward low-acuity patients or patients requiring minor procedures and took advantage of their efficiency and skills in these areas. It is also possible that residents self-selected these patients to maximize their own level of comfort.

A similar retrospective review conducted within the same institution compared the resident–patient encounters of pediatric versus nonpediatric residents rotating in the PED over 1 year.[7] The study focused on patients triaged as critical, those who died in the ED, and those who were admitted to the pediatric intensive care unit (PICU) to determine if there were differences in the exposure to critically ill children between the two resident groups. Overall, critical patients (n = 3,048) represented 4% of the total ED volume for the year. EM residents were involved in 903 (30%) of the cases, while pediatric residents were involved in 2003 (65%). The number of critically ill patients managed per 10 shifts were nine for pediatric residents versus five for EM residents ($p < 0.0001$).[7] The number of critical patients managed with advancing level of training increased for pediatric but not for EM residents.

Despite the fact that the aforementioned two studies were performed at the same institution, which limits their generalizability, they do raise important questions for program directors who must choose the best environment for resident exposure to pediatric patients. First, program directors must be aware that, paradoxically, regional or tertiary care children's hospitals may not always be the ideal site for PEM training, particularly if used as the sole site for such experience. Due to geographic constraints and competition from multiple EM programs in certain areas, large numbers of rotating residents at any given time may dilute the educational experience. Program directors should think about more effective use of multiple regional centers for training, varying the number and type of sites used. However, the authors do recognize the need to comply with ACGME standards and that use of additional sites may not be economically viable or logistically feasible. Another possibility is to have residents work collaboratively to share the experience of managing the less common critically ill patients to share in the teaching and procedural experience. Program directors must also assure that EM residents are not preferentially shunted toward lower-acuity patients because they do not have the ''home court advantage'' or comfort level necessary for more critical cases. Other studies have also documented that children in EDs overall have a lower acuity than adults,[8] so it is clear that supplemental experiences will be needed no matter which venue is chosen as a training site to improve the odds of exposure to low-frequency, high-impact learning cases. It is clear that more current data are needed to critically reexamine this aspect of EM training before program directors make substantial changes in training site selection.

Pediatric EM residency curriculum challenges are numerous and varied. The most common locations for PEM learning remain the PED and the PICU. Tracking pediatric experiences in EM residency remains difficult. Competition for high-volume PED rotation sites continues to be a large problem. Given that children's hospitals are typically urban in location, urban EM residency programs tend to be at an advantage for access to these experiences. PEM physicians are rising in numbers, both in PEDs and in general EDs. An ever-rising number of PEDs embedded within general hospitals are being established, drawing PEM encounters away from general hospital EDs. These PEDs are typically staffed with pediatricians and PEM physicians. The net loss of pediatric visits per EP will affect the comfort of core EM faculty with and ability to teach PEM in the ED.

Sufficient exposure of EM residents to children across age, disease, and acuity spectra remains difficult to provide in the core EM curriculum. Varying ages included in the term ''pediatrics'' should be covered in EM residents' educational experience. Examination of EM residency education today mandates careful review of the EM model of practice as it relates to children. The Model of Clinical Practice of EM is a three-dimensional evidence-based description of EM practice.[9] The dimensions serve as the foundation for clinical EM practice and include patient acuity, physician tasks, and the listing of conditions and components. First published in 2001, this comprehensive document was developed through collaboration by six organizations and serves as a road map for both planning and assessment of resident training programs by EM education stakeholders.[9] The model is reviewed and updated biannually by a committee composed of individual representatives from each of the six organizations. Notably absent from the list of contributors is representation from pediatric academic organizations, such as the American Academy of Pediatrics (AAP), the American Board of Pediatrics (ABP), or the Association of Pediatrics Program Directors. While acuity and condition are given ''dimension'' status in the Model of Clinical Practice of EM document, the role of age is given a less prominent role, listed within the dimension ''physician tasks,'' under the subheading ''modifying factors.'' According to the model, an EM resident physician must learn to ''recognize age, sex, ethnicity, barriers to communication, socioeconomic status, underlying disease, and other factors that may affect patient management.''[9] The model's primary focus on patient acuity effectively minimizes the majority of PEM diagnoses, which may result in missed opportunities to learn the subtleties of pediatric disease presentation and/or those that may precede overwhelming illness in children. Also, high-acuity PEM diagnoses occur far less frequently than moderate- to low-acuity diagnoses; EPs must learn and be prepared to care for the majority of moderate as well as low-acuity pediatric patients who will visit their EDs, in addition to those with high-stakes conditions. There is no mention of influences on pediatric clinical presentations, such as developmental age or psychosocial environment. There is no direction given to the EM residency director on how to teach the resident physician the art of partnering with the pediatric patient's parent(s) to best care for the child in question. Adding age as the model's fourth dimension may provide an incentive for EM residency educators to fill the aforementioned curricular gaps in PEM knowledge base and skills.

OPPORTUNITIES AND SOLUTIONS

Today's EM residency approach to PEM education is typically to offer dedicated PEM blocks, integrated EM blocks, or a combination of both. A sampling of educational approaches from the authors' institutions, as well as those of others involved in the Academic Assembly discussion, are illustrated in the following paragraphs. These institutions include The Children's Hospital of Philadelphia, Indiana University, the University of Michigan, Drexel University's St. Christopher's Hospital for Children, Temple University, and Duke University. For example, at one author's program (JB), the EM residents spend 20 weeks rotating through a tertiary care children's hospital over the course of a 4-year residency, 1 week in anesthesia, and 4 weeks in the PICU. At another institution, EM residents spend three 4-week rotations in a tertiary care children's hospital ED over a 3-year residency. In addition to this, they

have integrated EM blocks where shifts in the university hospital's PED are integrated into a schedule of EM shifts. Advantages of dedicated PEM blocks are the intensive PEM content and the experienced PEM faculty, whereas integrated EM blocks offer continuous PEM exposure that reflects the ''real-world'' setting and captures the seasonality of PEM practice.

FUTURE DIRECTIONS: MAXIMIZING EVERY PEDIATRIC ENCOUNTER

When surveying the future of PEM education, it is clear the future requires intervention by motivated educators able to find learning in every encounter. By highlighting unique components of PEM, residents can learn to care for children with the same confidence, enthusiasm, and safety as adult patients. Therefore, we recommend that EM program directors and PEM educators do three things within the context of well-established goals and learning objectives: 1) maximize each pediatric patient encounter with respect to patient safety, communication, and pediatric knowledge base; 2) create more frequent pediatric patient encounters; and 3) maintain the learner's pediatric awareness through longitudinal curricular immersion throughout residency. The following overview provides examples of the components of such ideal training by using each aspect of a pediatric encounter, in a temporal manner, as a teaching opportunity.

Before the Encounter: Simulation in PEM

Simulation in PEM is a tool used extensively in EM residency education and is embraced by EM learners.[10] Simulation in pediatrics and PEM is not prevalent[11] and has encountered barriers to implementation; questions of long-term effectiveness have been raised.[12] Nonetheless, the opportunity exists to increase meaningful pediatric-specific exposure through this teaching modality. A comprehensive PEM simulation curriculum has been described for EM residents. This 1-day curriculum was not effective for retention of pediatrics knowledge over time; however, suggestions for frequent goal-specific sessions are promising.[13] Simulation affords the ability to ''see'' children with rare disease processes, complex medical management needs, and difficult interpersonal and communication needs.[10] Learners reap benefits from feedback and training in team building and communication skills critical to any pediatric resuscitation.[14] Target subjects and topics for PEM simulation are virtually endless, but can include neonatal resuscitation, pediatric acute care, and trauma care. Cases involving children less than 2 years old and those with complex medical problems should be given special attention in the future, as these are more likely to be seen in smaller volumes during residency training. These populations are associated with greater anxiety and potentially inadequate equipment and services once in practice.

An alternative to the simulation lab is either high- or low-fidelity simulation cases in situ, where a high-fidelity wireless mannequin or child mannequin is placed in an ED room. These situations can serve as high intensity experiences and are often most helpful to learn vital aspects of one's own clinical environment. Such questions as ''where is the warmer?'' or ''do we have pediatric LMAs in our airway tray?'' or ''show me how to set up jet ventilation'' are considerations for subject matter in the mock ''code'' or ED-based case. Low-fidelity simulation is also useful when communication with parents or family members is the real learning objective, and the mannequin is more of a placeholder or prop.

During the Encounter: Avoiding Error

Pediatric resuscitations, more than perhaps any event in the ED, increase the ''cognitive load'' of patient care. Cognitive load is simply defined as the ability to recall information in a familiar situation versus an unfamiliar one; for example, reading in a foreign language instead of one's native tongue. Major sources of stress during pediatric ED critical care events decrease the ability of the provider to reliably calculate appropriate doses of important medications and choose appropriately sized equipment for procedures.[15] Medical errors are reported as the eighth leading cause of death, with medication errors the second most frequent and second most expensive event causing liability claims. One study found that 15% of admissions to a neonatal intensive care unit or PICU involve or were the result of a medication error.[16] Most medication errors on admitted pediatric patients were in children less than 2 years old, making them particularly vulnerable. Kaushal[17] examined pediatric inpatients in two children's hospitals and found 55 medication errors for every 100 admissions.

Education and appreciation of pediatric-specific patient safety issues and resources should be an integral part of the PEM curriculum for EM residents.[18] The use of hand-held technology should be considered as a supplement to patient care for drug dose calculations, equipment selection, and all weight-based aspects of a pediatric resuscitation. There are many of these programs available in multiple formats; a sampling of these ''tech tools'' is listed in Table 2.

During the Encounter: Patient- and Family-centered Care

Parental presence and family support in the ED have been embraced by multiple professional organizations including the AAP, American College of Emergency Physicians, and Emergency Nurses Association. Despite these endorsements and evidence-based recommendations for implementation, patient- and family-centered care remains an elusive goal in most EDs. A growing

Table 2
Hand-held Electronic References

Supplemental Tool	Location/platform
http://bilitool.org/	Internet-based
Pedi STAT	iPhone
http://www.kidometer.com/Info.html	Palm
http://webstore.lexi.com/ Lexi-PEDIATRIC-SUITE	iPhone

Table 3
Best Educational Practices in PEM for EM Residents

1. Parallel the educational approach used for other patient populations in general EM. Residents should be encouraged to approach the complaints of pediatric emergency department patients in the same way in which they approach those of adult patients—to consider life-threatening conditions first and to rule out such conditions even if they are perceived to be rare in children.
2. Stress the importance of child development (physical, cognitive, behavioral, and emotional) as a mitigating factor in the diagnosis, treatment, and long-term outcomes of ill or injured children.
3. Stress the importance of congenital illness, sequelae of prematurity, and technology dependence as mitigating factors in the diagnosis and treatment of pediatric patients.
4. Address the greater impact of seasonality on pediatric illness and injury.
5. Address the disproportionate role that infectious disease plays in the etiology of pediatric illness.
6. Address the impact of nonaccidental trauma as a cause of injury in the pediatric population.
7. Address the unique vulnerabilities of pediatric emergency patients from a patient safety standpoint.
8. Aim to embrace and incorporate the principles of family centered care into all aspects of education and practice.
9. Establish a mechanism for measuring procedural competence specific to the practice of PEM.
10. Establish a mechanism for reviewing individual resident data and composite rotation data.
PEM = pediatric emergency medicine.

body of evidence supports the contention that both families and providers benefit from family presence during pediatric procedures and resuscitations.[19–41] Because families are the surrogate medical decision-makers for children, facilitating their presence in the ED allows for improved patient comfort, information exchange between providers and family, and even grief responses.[19] The option for family presence during invasive procedures or resuscitation in children should be role modeled for EM residents, and a discussion of the potential merits of the practice should be incorporated into the PEM curriculum.

During the Encounter: Direct Observation and Bedside Teaching

Communication in pediatric emergency patient care is unique and covers issues ranging from the seemingly common sense and simple (e.g., infant feeding) to the potentially sensitive and adversarial (e.g., nonaccidental trauma evaluations). EM physicians in training who lack pediatric primary care exposure may transform a simple patient encounter into a complex one. A first attempt at giving instructions for a particular discharge diagnosis or delivering the news of an imminent nonaccidental trauma evaluation or even instructions regarding normal infant feeding patterns are best treated as first-time procedures for EM residents. They should be discussed in detail and then observed by faculty to preserve a memory of how those interactions should unfold.

In addition to communication, the age and developmentally specific pediatric history and physical examination have certain points that only are perfected after demonstration and modeling. The developmental history, diet history, and birth history are essential components of the ED history of present illness that should not be overlooked; they are frequently pertinent to many common pediatric emergencies, including nonaccidental trauma.[42]

After the Encounter: Asynchronous Learning

Emergency medicine residents are often self-directed learners who have excelled throughout academic life. Traditional didactics may not suit this type of adult learner through the duration of their specialty training. Asynchronous learning is a student-centered teaching method that uses online learning resources to facilitate information sharing outside the constraints of time and place among a network of people.[43] Several types of asynchronous learning exist for supplementation of the traditional didactic framework and have been recognized by the Residency Review Committee (RRC) and ACGME. Online module learning brings the power of case-based reading to the student by incorporating lecture (narrated, video-recorded, podcast), literature (state of the art review, evidence-based medicine), and self-assessment into an easily accessible forum.

The individualized learning plan also holds great promise for asynchronous learning possibilities. In *Pediatric Emergency Care* in 2008, an automatic electronic case log was described for PEM fellows that tracked multiple core components over the 3 years of fellowship, including diagnoses, efficiency of patient care, and acuity of patients seen.[44] Curricular deficits could easily be identified and supplemented for each individual learner.

In summary, the education of the future EM resident can and should be enhanced by attention to safety concerns, increasing patient exposure through simulation and expanding knowledge base through asynchronous learning.

SUMMARY OF GUIDING PRINCIPLES FOR PEM CURRICULUM DESIGN

When designing or refining a PEM curriculum for EM residents, we recommend that the following set of questions and subquestions be used as guiding principles:

1. What is the optimal structure of rotations?

Will residents be better served by accumulating PEM patient experience during dedicated block rotations, in an integrated longitudinal fashion throughout the calendar year or a mixture of the two? How will the PEM curriculum assure that residents are exposed to seasonal variations in pediatric illness and injury?

2. Are the learning objectives appropriate and realistic to be met by the available formats for learning?

Which PEM content is best suited for classroom learning versus bedside learning? Do these experiences require supplementation outside of these traditional

formats or with new educational methods and technologies?

3. Is there a framework for measuring competency in PEM in the proposed curriculum?
Are standard tracking and assessment tools applicable and available for adaptation to a customized PEM curriculum? How can these tools provide data to support curriculum revisions and are there established times for curriculum evaluation?

4. Is there a system in place to monitor and evaluate the PEM experience with the goal of making data-driven systemic improvements?
Will the program director have access to resident level data? At what intervals should these data be optimally reviewed? How do we define threshold indicators in the data that signal a need for a possible change of venue for a pediatric rotation or a modification to the entire PEM curriculum?

In addition to following the ACGME RRC-EM recommendations for pediatric encounters, and choosing training sites that provide clinical experiences reflective of the EM Model of Clinical Practice, we highly encourage program directors and other faculty to incorporate the following concepts in a PEM curriculum designed for EM residents. Best educational practices in PEM for EM residents should strive to achieve the following as summarized in Table 3:

1. Parallel the educational approach used for other patient populations in general EM. Residents should be encouraged to approach the complaints of PED patients in the same way in which they approach those of adult patients—to consider life-threatening conditions first and to rule out such conditions even if they are perceived to be rare in children.
2. Stress the importance of child development (physical, cognitive, behavioral, and emotional) as a mitigating factor in the diagnosis, treatment, and long-term outcomes of ill or injured children.
3. Stress the importance of congenital illness, sequelae of prematurity, and technology dependence as mitigating factors in the diagnosis and treatment of pediatric patients.
4. Address the greater impact of seasonality on pediatric illness and injury.
5. Address the disproportionate role that infectious disease plays in the etiology of pediatric illness.
6. Address the impact of nonaccidental trauma as a cause of injury in the pediatric population.
7. Address the unique vulnerabilities of pediatric emergency patients from a patient safety standpoint.
8. Aim to embrace and incorporate the principles of family centered care into all aspects of education and practice.
9. Establish a mechanism for measuring procedural competence specific to the practice of PEM.
10. Establish a mechanism for reviewing individual resident data and composite rotation data.

THE FUTURE OF PEM IN EM, THE FELLOWSHIP CONUNDRUM, AND THE CALL TO LEADERSHIP

The landscape of PEM is rapidly changing, and EM must consider its future relevance in the subspecialty. The number of board-certified PEM specialists with primary training and certification through the American Board of Emergency Medicine (ABEM) is low compared to the number who are trained and certified via the ABP. To elevate the level of emergency care for children across all care environments, PEM must be promoted as a vital part of residency training and a viable fellowship training option for EM graduates. To chart a realistic path toward this goal, we have assessed the current state of PEM training in EM residencies and have suggested a more contemporary set of educational practices as discussed above. As an important next step, EM must also address and remove barriers, both cultural and financial, preventing residents from seeking further training via PEM fellowships.

Pediatric EM is a certified subspecialty available to both pediatric and EM residents upon completion of an accredited fellowship through a single examination. Since the first board certification examination was offered in 1992, PEM has grown steadily and now has approximately 1,300 certified practitioners as of 2005.[45] PEM has become the third most popular subspecialty selected by pediatric residency graduates.[45] This has resulted in more than 89% (1,170 practitioners) of those certified being via ABP.[45] A mere 3% (170 practitioners) of EM graduates are certified through ABEM as PEM physicians.[45]

The distribution of PEM practitioners, based on training background, has concentrated the PEM workforce in the country's 160 tertiary care children's hospitals where PEM practitioners are uniquely qualified to staff these EDs. However, 80% to 90% of all pediatric emergencies are seen outside of a children's hospital. In addition, despite the popularity of PEM among pediatric residency graduates, there continues to be a relative shortage of PEM practitioners as the majority are concentrated in tertiary centers. As of 2005 there were only 1.6 PEM practitioners per 100,000 people, whereas there were 1.9 pediatric oncologists.[45] Only 23% of U.S. hospitals have PEM coverage, and approximately 40% of EDs cover their pediatric needs with general pediatricians. Rural areas are underserved with regard to pediatric emergency services, with only 3% of the PEM workforce.[45] Although both EM and pediatric-trained practitioners see the vast majority of PED visits, only approximately 5.5% of general pediatric residency training and 16% of general EM residency training is directly related to PEM.[3] To summarize these current trends overall, 90% of the PEM workforce is seeing only 10% to 20% of the pediatric emergency visits while the majority of PEM visits are seen by non–PEM-boarded physicians with varying degrees of experience and comfort with pediatric patients.

Despite the current disparities in workforce distribution and the apparent demand for PEM practitioners, the field remains relatively unpopulated by graduates of EM residencies. A number of economic, practical, and

cultural barriers potentially prevent them from pursuing further training. Economically, PEM fellowship graduates on average earn less than their non–fellowship EM-trained colleagues due to lower overall reimbursement rates for pediatric visits relative to adult emergency visits. This is further compounded by the lost income over the 2- to 3-year training period. Coupled with the prospect of a pay cut and the reality that EM graduates, technically, do not require additional training beyond their base certification to see children, the case for pursuing additional PEM training is severely weakened. Such logic, however, may become obsolete as pediatric based practitioners successfully fill positions within many hospitals seeking to upgrade their pediatric emergency services. As of 2007, graduating PEM fellows were averaging five job offers each at the conclusion of training, with most of these positions being clinically oriented.[46] By advertising PEM services provided by ''board-certified'' PEM specialists in pediatric focused EDs, hospitals perceive and often obtain an advantage in competitive markets. Such segregation of pediatric emergency patients, as previously mentioned, will result in EM practitioners having fewer opportunities to care for children and will lead inevitably to skill degradation. This skill degeneration will have two effects: a reduction in the pool of available EM practitioners to train future residents, but more importantly, residents may begin to question the value of PEM education within residency programs if they perceive that this knowledge base would rarely, if ever, be drawn upon.

While there are many challenges facing EM with regards to PEM fellowship participation, there are several benefits to additional training. Fellowship in general has been linked to greater levels of job satisfaction within many medical fields.[46] Developing specialized expertise within a field allows individuals to be resources to their colleagues and their institutions and can facilitate leadership on regional and national levels.[46] More specifically, given the large cultural shifts within PEM and the current emphasis on PEC highlighted in the IOM report,[1] opportunities for leadership exist at almost every level in both academic and community hospitals. For regional hospitals where children may represent 25% of the ED census, a PEM-trained EM graduate is ideal for the creation of pediatric-centered protocols and policies, while still being qualified to care for emergency patients of any age.

If EM graduates are to assume roles as mentioned above, this will require a reexamination of how we present and conduct PEM training within EM residencies. If PEM education continues to be episodic and seemingly ancillary relative to the rest of the curriculum, PEM training will continue to recede from the purview of EM. PEM within EM programs will achieve the stature that we, as educators, create for it. To that end, we must undertake the following: 1) create early, high-quality, and longitudinal PEM educational experiences that impart upon EM residents the importance of a strong pediatric skill set for a successful career in EM; 2) create and preserve a cadre of educators and mentors for current EM residents and future EM/PEM physicians; 3) foster the growth of leaders in PEM research and education to serve alongside our pediatric trained colleagues; and 4) acknowledge the integral role of the general EM practitioner in PEC and not abdicate such responsibility for the quality of care rendered to the 80% to 90% of pediatric emergencies occurring outside pediatric specialty centers. This must be a major focus of leadership structures within organized EM and must occur in collaboration with pediatric focused professional organizations.

CONCLUSIONS

We have discussed EM's role within pediatric emergency medicine and the issues facing us as a specialty in a rapidly changing landscape. We have provided a review of the current training environments in EM residencies and identified educational challenges facing residency directors. The future of pediatric emergency medicine education calls for new ways to train our residents to provide excellence in the emergency care of children. We propose a set of best practices designed to promote high quality pediatric emergency medicine training by stressing pediatric core concepts such as the role of seasonality in illness, childhood development, the role of congenital disease, and the importance of family centered care, among others. We strongly advocate for educators to carefully evaluate the composition and quality of their pediatric rotations to maximize educational yield and benefit based on the summary of guiding principles provided. The common thread motivating all pediatric emergency medicine practitioners, regardless of training, is the welfare of children and this remains the overarching concern.

References

1. Institute of Medicine. Emergency Care for Children: Growing Pains. Available at: http://www.iom.edu/Reports/2006/Emergency-Care-for-Children-Growing-Pains.aspx. Accessed Jul 13, 2010.
2. Pitts SR, Niska RW, Xu J, Burt CW. National Hospital Ambulatory Medical Care Survey: 2006 emergency department summary. Adv Data. 2008; 6:1–38.
3. Accreditation Council for Graduate Medical Education. ACGME Program Requirements for Graduate Medical Education in Emergency Medicine. Available at: http://acgme.org/acWebsite/downloads/RRC_progReq/110emergencymed07012007.pdf. Accessed Jul 13, 2010.
4. Tamariz VP, Fuch S, Baren JM, Pollack ES, Kim J, Seidel JS. Pediatric emergency medicine education in emergency medicine training programs. Acad Emerg Med. 2000; 7:774–8.
5. Christopher N. Pediatric emergency medicine education in emergency medicine training programs [commentary]. Acad Emerg Med. 2000; 7:797–9.
6. Chen EH, Shofer FS, Baren JM. Emergency medicine resident rotation in pediatric emergency medicine: what kind of experience are we providing? Acad Emerg Med. 2004; 11:771–3.

7. Chen EH, Cho CS, Shofer FS, Mills AM, Baren JM. Resident exposure to critical patients in a pediatric emergency department. Pediatr Emerg Care. 2007; 23:774–8.
8. Green R. Emergency department children are not as sick as adults: implications for critical care skills retention in an exclusively pediatric emergency medicine practice. J Emerg Med. 2009; 37:359–36.
9. Thomas HA, Beeson MS, Binder LS, et al. The 2005 model of the clinical practice of emergency medicine: the 2007 update. Acad Emerg Med. 2008; 15:776–9.
10. Farrell SE, Coates WC, Kuhn GJ, Fisher J, Shayne P, Lin M. Highlights in emergency medicine medical education research: 2008. Acad Emerg Med. 2009; 16:1318–24.
11. Calaman S, McGregor RS, Spector ND. How can we assure procedural competence in pediatric residents in an era of diminishing opportunities? The answer is simulation-based training. J Pediatr. 2010; 156:865–6.
12. Biese K, Moro-Sutherland D, Furberg RD, et al. Using screen-based simulation to improve performance during pediatric resuscitation. Acad Emerg Med. 2009; 16:S71–5.
13. Adler MD, Vozenilek JA, Trainor JL, et al. Development and evaluation of a simulation-based pediatric emergency medicine curriculum. Acad Med. 2009; 84:935–41.
14. Donoghue AJ, Durbin DR, Nadel FM, Stryjewski GR, Kost SI, Nadkarni VM. Effect of high-fidelity simulation on pediatric advanced life support training in pediatric house staff. Pediatr Emerg Care. 2009; 25:139–44.
15. Luten R, Zaritsky A. The sophistication of simplicity ... optimizing emergency dosing. Acad Emerg Med. 2008; 15:461–5.
16. Selbst SM, Levine S, Mull C, Bradford K, Friedman M. Preventing medical errors in pediatric emergency medicine. Pediatr Emerg Care. 2004; 20:702–9.
17. Kaushal R. Medication errors and adverse drug events in pediatric inpatients. JAMA. 2001; 285: 2214–20.
18. Frush KS. Medication errors in pediatric emergency medicine: developing a national standard. Ann Emerg Med. 2007; 50:369–70.
19. Farah MM, Thomas CA, Shaw KN. Evidence-based guidelines for family presence in the resuscitation room: a step-by-step approach. Pediatr Emerg Care. 2007; 23:587–91.
20. American Academy of Pediatrics, Committee on Pediatric Emergency Medicine, American College of Emergency Physicians, & Pediatric Emergency Medicine Committee. Patient- and family-centered care and the role of the emergency physician providing care to a child in the emergency department. Pediatrics. 2006; 118:2242–4.
21. American Association of Critical Care Nurses (2006). Practice Alert: Family Presence During CPR and Invasive Procedures. Available at: http://www.aacn.org. Accessed Apr 5, 2010.
22. Burnette K, Ramundo M, Stevenson M, Beeson MS. Evaluation of a web-based asynchronous pediatric emergency medicine learning tool for residents and medical students. Acad Emerg Med. 2009; 16(Suppl 2):S46–50.
23. Boie ET, Moore GP, Brummett C, Nelson DR. Do parents want to be present during invasive procedures performed on their children in the emergency department? A Survey of 400 parents. Ann Emerg Med. 1999; 34:70–4.
24. Boudreaux ED, Francis JL, Loyacano T. Family presence during invasive procedures and resuscitations in the emergency department: a critical review and suggestions for future research. Ann Emerg Med. 2002; 40:193–205.
25. Bradford KK, Kost S, Selbst SM, Renwick AE, Pratt A. Family member presence for procedures: the resident's perspective. Ambu Pediatr. 2005; 5: 294–7.
26. Brown K, Mace SE, Dietrich AM, Knazik S, Schamban NE. Patient and family-centered care for pediatric patients in the emergency department. Can J Emerg Med. 2008; 10:38–43.
27. Dudley NC, Hansen KW, Furnival RA, Donaldson AE, Van Wagenen KL, Scaife ER. The effect of family presence on the efficiency of pediatric trauma resuscitations. Ann Emerg Med. 2009; 53:777–84.
28. Eckle N, MacLean SL. Assessment of family-centered care policies and practices for pediatric patients in nine US emergency departments. J Emerg Nurs. 2001; 27:238–45.
29. Eppich WJ, Arnold LD. Family member presence in the pediatric emergency department. Curr Opin Pediatr. 2003; 15:294–8.
30. Fein JA, Ganesh J, Alpern ER. Medical staff attitudes toward family presence during pediatric procedures. Pediatr Emerg Care. 2004; 20:224–7.
31. Helmer SD, Smith RS, Dort JM, Shapiro WM, Katan BS. Family presence during trauma resuscitation: a survey of AAST and ENA members. J Trauma. 2000; 48:1015–24.
32. MacLean SL, Guzzetta CE, White C, et al. Family presence during cardiopulmonary resuscitation and invasive procedures: practices of critical care and emergency nurses. Am J Crit Care. 2003; 12:246–57.
33. Mangurten J, Scott SH, Guzzetta CE, et al. Effects of family presence during resuscitation and invasive procedures in a pediatric emergency department. J Emerg Nurs. 2006; 32:225–33.
34. McClenathan CB, Torrington CK, Uyehara CF. Family member presence during cardiopulmonary resuscitation: a survey of US and international critical care professionals. Chest. 2002; 122:2204–11.
35. Moreland P. Family presence during invasive procedures and resuscitation in the emergency department: a review of the literature. J Emerg Nurs. 2005; 31:58–72.
36. Mortelmans LJ, Cas WM, Van Hellemond PL, De Cauwer HG. Should relatives witness resuscitation in the emergency department? The point of view of the Belgian emergency department staff. Eur J Emerg Med. 2009; 16:87–91.
37. O'Brien MM, Creamer KM, Hill EE, Welham J. Tolerance of family presence during pediatric cardiopulmonary resuscitation: a snapshot of military and

civilian pediatricians, nurses, and residents. Pediatr Emerg Care. 2002; 18:409–13.
38. O'Malley PJ, Brown K, Krug SE, Committee on Pediatric Emergency Medicine. Patient- and family-centered care of children in the emergency department. Pediatrics. 2008; 122:e511–21.
39. Pruitt LM, Johnson A, Elliott JC, Polley K. Parental presence during pediatric invasive procedures. J Pediatr Health Care. 2008; 22:120–7.
40. Sacchetti A, Carraccio C, Leva E, Harris RH, Lichenstein R. Acceptance of family member presence during pediatric resuscitations in the emergency department: effects of personal experience. Pediatr Emerg Care. 2000; 16:85–7.
41. Bayreuther J, Macgregor A, Sajjanhar T. Management of limb fracture in children under 1 year of age in a dedicated pediatric emergency department. Emerg Med J. 2009; 26:173–6.
42. Mayadas F. Asynchronous learning networks: a Sloan Foundation perspective. J Asynchron Learn Network. 1997; 1:e1.
43. Bachur R, Nagler J. Use of an automated electronic case log to assess fellowship training: tracking the pediatric emergency medicine experience. Pediatr Emerg Care. 2008; 24:75–82.
44. Althouse LA, Stockman JA 3rd. Pediatric workforce: a look at pediatric emergency medicine data from the American Board of Pediatrics. J Pediatr. 2006; 149:600–2.
45. Vu T, Hampers L, Joseph MM, et al. Job market survey of recent pediatric emergency medicine fellowship graduates. Pediatr Emerg Care. 2007; 23: 304–7.
46. Stern S. Fellowship training a necessity in today's academic world. Acad Emerg Med. 2002; 9:713–6.