Pediatric Emergency Medicine Residency Experience: Requirements Versus Reality

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Abstract

Background An important expectation of pediatric education is assessing, resuscitating, and stabilizing ill or injured children.

Objective To determine whether the Accreditation Council for Graduate Medical Education (ACGME) minimum time requirement for emergency and acute illness experience is adequate to achieve the educational objectives set forth for categorical pediatric residents. We hypothesized that despite residents working five 1-month block rotations in a high-volume (95 000 pediatric visits per year) pediatric emergency department (ED), the comprehensive experience outlined by the ACGME would not be satisfied through clinical exposure.

Study Design This was a retrospective, descriptive study comparing actual resident experience to the standard defined by the ACGME. The emergency medicine experience of 35 categorical pediatric residents was tracked including number of patients evaluated during training and patient discharge diagnoses. The achievability of the ACGME requirement was determined by reporting the percentage of pediatric residents that cared for at least 1 patient from each of the ACGME-required disorder categories.

Results A total of 11.4% of residents met the ACGME requirement for emergency and acute illness experience in the ED. The median number of patients evaluated by residents during training in the ED was 941. Disorder categories evaluated least frequently included shock, sepsis, diabetic ketoacidosis, coma/altered mental status, cardiopulmonary arrest, burns, and bowel obstruction.

Conclusion Pediatric residents working in one of the busiest pediatric EDs in the country and working 1 month more than the ACGME-recommended minimum did not achieve the ACGME requirement for emergency and acute illness experience through direct patient care.

Introduction

One important expectation of pediatric residency is imparting the physician with the ability to assess rapidly, resuscitate, and stabilize an ill or injured child. Most pediatricians, regardless of their practice environments, will encounter patients in need of emergent resuscitation and stabilization. Pediatric emergency departments (EDs) traditionally have sought opportunities to teach the cognitive and psychomotor skills needed for early recognition, resuscitation, and management of ill and injured pediatric patients.

The Accreditation Council for Graduate Medical Education (ACGME) has set minimum standards for pediatric residency training, including both a minimum time requirement spent learning in a pediatric emergency medicine (PEM) department as well as expectations for the breadth of exposure during that time.[1] The ACGME describes what should be accomplished during this "comprehensive experience" in emergency and acute illness for pediatric residency training. The list is lengthy and includes exposure to medical and surgical conditions such as cardiopulmonary arrest, appendicitis, diabetic ketoacidosis, poisonings, physical and sexual abuse, and major trauma. These standards are meant to ensure that training programs graduate pediatricians capable of properly recognizing and treating children with these acute illnesses. It is unclear which of these suggested conditions are more or less likely to be encountered during the PEM clinical training experience.

The objective of this study was to determine whether the 4-month minimum time requirement for emergency and

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acute illness experience set forth by the ACGME Residency Review Committee for Pediatrics is sufficient to achieve the expected clinical experience for categorical pediatric residents. We suspected that despite residents working five 1-month block rotations in a high-volume (95 000 pediatric visits per year), urban, pediatric ED and level I trauma center, the "comprehensive experience" in PEM as outlined by the ACGME would not be achieved through clinical exposure alone.

Methods

Study Design

This was a retrospective, descriptive study comparing actual resident experience to the standard defined by the ACGME.

Study Setting and Population

The study population included categorical pediatric residents at Cincinnati Children's Hospital Medical Center (CCHMC) who were required to do a single 1-month block of PEM during the first year and two 1-month blocks each year during the subsequent 2 years. All patient encounters in the ED were directly supervised at the time of the encounter by board-certified or board-eligible PEM faculty physicians. Inclusion criteria included all CCHMC categorical pediatric residents in the graduating class of 2006. Exclusion criteria included any graduating pediatric resident who did not complete 5 months of PEM.

Study Protocol

The roster of all CCHMC categorical pediatric residents graduating in 2006 was obtained by the primary investigators. The CCHMC electronic medical record (EMR) system was queried by a data analyst generating a database of the following information: resident physician name, number of shifts worked during training, number of patients evaluated during training, and patient discharge diagnoses. No patient identifiers or protected health information were collected. Each resident physician's name was substituted with a unique identifier so as not to link a specific resident with a specific experience, preserving each resident's confidentiality. The key for the unique identifiers was unavailable to anyone except the data analyst. The list of all possible EMR discharge diagnoses was coded by the primary investigators into the "disorder categories" of the ACGME Program Requirements for Pediatrics, covering emergency and acute illness experience (TABLE 1). For example, all accidental medication ingestions were grouped under the diagnosis of poisoning/ingestion.

The study was reviewed and determined to be exempt by the CCHMC Institutional Review Board.

Measurements and Outcomes

The achievability of the ACGME "comprehensive experience" requirement was determined by calculating the proportion of categorical pediatric residents who evaluated at least 1 patient from each of the "disorder categories," thereby meeting the Residency Review Committee requirement for emergency and acute illness experience through clinical exposure. The percentage of residents evaluating at least 5 patients in each individual disorder category was reported to identify potential common areas of deficiency in clinical experience. The total number of shifts worked and total number of patients evaluated by each resident was also reported.

TABLE 1 Accreditation Council for Graduate Medical Education Disorder Categories in Emergency and Acute Illness

Disorder Categories in Emergency and Acute Illness	
Abscess drainage	Head trauma
Appendicitis	Major trauma
Asthma	Minor trauma
Bowel obstruction	Poisoning/ingestion
Burns	Physical/sexual abuse
Cardiopulmonary arrest	Psychiatric/behavioral
Childhood exanthems	Pyelonephritis
Chronic disease—acute problems	Respiratory failure
Coma/altered mental status	Respiratory infection
Dehydration	Seizures
Diabetic ketoacidosis	Sepsis
Fever	Shock
Foreign body inhalation/ingestion	Skin disorders

Data Analysis

The available discharge diagnoses were coded into the disorder categories by consensus among the study investigators. There were 2933 available discharge diagnoses for assignment. Not all of the available discharge diagnoses could be classified into 1 of the ACGME disorder categories. Diagnoses were included in a category when it was felt that clear relevance to that category existed. Additionally, diagnoses were included in a category if it was felt that discussion and education around that particular category would likely have occurred during the course of evaluating the patient.

Data were analyzed using simple, descriptive statistics and are presented as medians, ranges, and proportions.

Results

A total of 35 categorical pediatric residents graduated in the class of 2006, and all completed required rotations in the pediatric ED. These residents evaluated 33 155 patients

during 3478 ten-hour ED shifts. Among the residents, 11.4% (4/35) evaluated at least 1 patient from every 1 of the 26 ACGME-required disorder categories. No (0/35) graduating pediatric resident evaluated 2 or more patients from every required disorder category during his or her time rotating through the ED.

The median number of patients evaluated by residents during training in the ED was 941, with a range of 707 to 1176. The median number of 10-hour pediatric ED shifts worked by residents during training was 101, with a range of 71 to 118. The median number of patients evaluated per shift during training was 9.5 with a range of 8 to 11.

The median numbers and ranges of patients evaluated per resident in each disorder category are presented in TABLE 2. Disorder categories evaluated least frequently included shock, sepsis, diabetic ketoacidosis, coma/altered mental status, cardiopulmonary arrest, burns, and bowel obstruction. Categories with the greatest number of residents not assigning a single qualifying diagnosis included cardiopulmonary arrest (22/35 residents), shock (20/35 residents), and altered mental status (6/35 residents). Although not an explicit ACGME disorder category, 6 of 35 residents appear not to have evaluated a patient with meningitis during their PEM experiences. Categories that included the largest numbers of patients evaluated included asthma, dehydration, fever, minor trauma, psychiatric/behavioral, respiratory infection, and skin disorders. A median of 3.7% (range, 1.7%–8.1%) of the resident encounters resulted in a final diagnosis of ''diagnosis not found'' in the EMR documentation.

Finally, to better segment disorder categories according to resident exposure, a more stringent definition of exposure was applied. The percentage of residents evaluating at least 5 patients in each disorder category is reported in TABLE 3. No resident evaluated at least 5 patients diagnosed with cardiopulmonary arrest or shock, and only 3 of 35 residents evaluated at least 5 patients with bowel obstruction, coma/altered mental status, or sepsis.

TABLE 2 **Medians and Ranges of Patients Evaluated in Each Accreditation Council for Graduate Medical Education Disorder Category**

Disorder Category	Median Number of Patients Evaluated per Resident	Range for Number of Patients Evaluated
Cardiopulmonary arrest	0	0–3
Shock	0	0–3
Coma/altered mental status	2	0–5
Sepsis	2	0–8
Diabetic ketoacidosis	2	0–6
Bowel obstruction	3	0–6
Burns	3	0–8
Poisoning/ingestion	6	0–11
Appendicitis	7	0–16
Foreign body inhalation/ingestion	7	2–19
Major trauma	8	0–17
Respiratory failure	8	3–22
Childhood exanthems	9	4–17
Physical/sexual abuse	10	2–20
Abscess drainage	10	4–18
Chronic disease—acute problems	11	6–20
Pyelonephritis	14	2–36
Seizures	28	15–48
Head trauma	30	16–45
Skin disorders	33	19–56
Psychiatric/behavioral	52	27–78
Fever	58	24–99
Asthma	67	39–88
Minor trauma	71	39–106
Dehydration	78	49–114
Respiratory infection	111	69–196

Discussion

The goal of residency training in general pediatrics is ''to provide educational experiences that prepare residents to become competent general pediatricians able to provide high quality care for a broad range of pediatric patients in the community.''[1] Competence in pediatrics, and in medicine in general, is challenging to define and to measure. The ACGME currently defines competence in pediatric emergency and acute illness care as exposure to at least 26 specific disorder categories without mention of the number or type of exposures required in each.

In the present study, only 11.4% of categorical pediatric residents satisfied this requirement through clinical exposure during their PEM experience despite rotating through one of the busiest pediatric EDs in the country[2] and spending 1 month more than the ACGME minimum time requirement. Residents were given credit for experience in a specific disorder category if even a single patient was evaluated from that category. For example, if a resident evaluated 1 patient with a diagnosis of bowel obstruction, it would have satisfied the requirement for exposure to this category. However, it is questionable whether that single patient exposure would truly lead to competence in the evaluation and diagnosis of bowel obstruction.

TABLE 3 **Percentage of Residents Evaluating at Least 5 Patients in Each Accreditation Council for Graduate Medical Education Disorder Category**

Disorder Category	Percentage of Residents Evaluating at Least 5 Patients in Category
Cardiopulmonary arrest	0
Shock	0
Bowel obstruction	9
Coma/altered mental status	9
Sepsis	9
Diabetic ketoacidosis	11
Burns	17
Poisoning/ingestion	69
Appendicitis	74
Respiratory failure	80
Foreign body inhalation/ingestion	89
Major trauma	89
Childhood exanthems	91
Physical/sexual abuse	94
Abscess drainage	97
Pyelonephritis	97
Asthma	100
Chronic disease—acute problems	100
Dehydration	100
Fever	100
Head trauma	100
Minor trauma	100
Psychiatric/behavioral	100
Respiratory infection	100
Seizures	100
Skin disorders	100

The ED provides an excellent venue for exposure to a large number of patients with undifferentiated illnesses and mirrors more accurately what a general pediatrician encounters in an office setting. This experience is distinctly different from that on inpatient wards or in an intensive care unit where patients have typically been assigned a diagnosis and a management plan well established prior to resident involvement with the patient. Residents' evaluation of patients with undifferentiated illnesses in the ED is critical to their development of differential diagnostic reasoning skills and an approach to medical decision making that is important to the primary care provider.

Our findings suggest that even in one of the highest volume pediatric EDs in the United States,[2] pediatric residents do not appear to be achieving the prescribed breadth of exposure suggested by the ACGME through clinical exposure alone. If breadth of exposure is a crucial component of training, are we graduating residents capable of recognizing and stabilizing critically ill children? A study by Bowen and Ball[3] published in 2003 showed that 26% to 35% of graduating pediatric residents routinely attended in an ED and approximately 30% reported an emergency encounter greater than once per week, regardless of practice setting. Additionally, in a survey of 60 community emergency physicians representing 23 institutions,[4] pediatric back-up systems at the community hospital ED consisted of private pediatric coverage for 53% of the respondents. This raises 2 important questions: Can pediatric ED rotations be expected to provide residents with enough clinical experiences from which to learn recognition and stabilization of critically ill children? If not, do clinical rotations such as inpatient wards and intensive care units provide enough additional educational experience in recognition and stabilization of acute illness to bridge the gap in knowledge deficit that remains after completion of ED rotations?

Prior studies have shown that resident exposure to critically ill patients in a pediatric ED is low.[5–7] Chen et al[5] reported that after a 4-week rotation in a high-volume (73 000 visits per year) pediatric ED, most residents had cared for less than 15 critically ill patients. Additionally, in the same high-volume pediatric ED, only 4.2% of patient visits were classified as critically ill. In the present study, diagnoses including shock, sepsis, diabetic ketoacidosis, coma/altered mental status, cardiopulmonary arrest, burns, and bowel obstruction were evaluated with very low frequencies similar to prior reports. In 1991, Krauss et al[6] reported frequencies of presenting illnesses to a large pediatric ED and found diagnoses such as major trauma (0.2%), poisoning (0.8%), and child abuse (1.1%) were relatively uncommon. Del Beccaro and Shugerman[7] reported that the proportions of residents that never saw a case of pyloric stenosis, intussusception, or diabetic ketoacidosis in the ED were 37%, 32%, and 32%, respectively. In a study of emergency medicine resident clinical experience, Langdorf et al[8] reported high proportions of residents not evaluating a single case of sudden infant death syndrome, intussusception, diabetic ketoacidosis, and various types of shock (cardiogenic, anaphylactic, and septic). In our study, the ranges for patients with sepsis and shock were 0 to 8 cases per resident and 0 to 3 cases per resident, respectively, and 57% (20/35) of residents did not assign a single qualifying diagnosis in the shock category during their PEM rotations. If this

limited clinical exposure is the primary source of education about these conditions, it seems unreasonable to expect trainees to develop comfort with recognizing and managing these diagnoses.

A study of internal medicine residents by Hayashino et al[9] aimed to determine the association between clinical exposure (defined by the number of cases seen) and quality of care delivered. The authors found that quality of care increased rapidly for the first 100 to 200 patients seen and then tapered. Interestingly, it was the total number of patients seen, regardless of their diagnoses, which correlated with improved quality of care and not the residents' previous experiences with the diagnoses themselves. In the present study, the range of the number of patients evaluated in the pediatric ED during residency far surpassed the threshold of importance in the Hayashino et al study. It is possible that, despite low-level exposure to some disorder categories, overall competence is still achieved through the high volume of patient encounters.

Given these areas of clinical deficiency, it is critical that residents' educational experiences are monitored and deficiencies identified and supplemented, and not left to chance and the mix of patients they care for as part of a clinical rotation. We feel strongly that during residents' PEM rotations, they learn to identify and initiate management for the following list of disorders unlikely to present from the outset during their other rotations: shock, respiratory failure, cardiopulmonary arrest, altered mental status, and major trauma. We also feel that focused learning opportunities addressing the recognition and initial management of these diagnoses, in addition to time spent evaluating patients in the clinical setting, are vital for residents to achieve competence and comfort identifying and treating these illnesses in the primary care setting. High-fidelity simulation and mock codes may provide residents with important opportunities to manage high-risk, critically ill patients presenting with low frequency (ie, shock or cardiopulmonary arrest).[10] Case-based teaching and video review conferences of actual patient encounters may also aid in providing additional knowledge and comfort with infrequently encountered diagnoses.[11] A survey of pediatric residency programs describing methods used for addressing the ACGME emergency and acute illness requirement and further clarification from the ACGME on outcome measures for assessing comprehensive experience would be important additions to the existing literature.

Limitations

In this study, residents were credited with "experience" only if they were primarily responsible for the care of the patient in the ED. It is possible that in some instances more than 1 resident cared for a single patient when it involved shift change. We could only assign the patient to the last resident who cared for him or her as documented in the EMR. Additionally, the assignment of the discharge diagnosis in the EMR was most often entered by the resident. In rare cases this may not have accurately reflected the discharge diagnosis, yet it is likely that education about the category occurred even if the initial diagnosis was incorrectly assigned. A median of 3.7% of the resident encounters resulted in a final diagnosis of "diagnosis not found" meaning that the resident did not or could not assign what he or she interpreted as the correct final diagnosis from the list of available diagnoses in the EMR. If these patients had been assigned to 1 of the ACGME disorder categories, this would add approximately 39 patients per resident during his or her training, and we feel that it is unlikely that this would significantly impact the deficiencies described.

It is well documented that there is seasonal variation to illness and injury presenting to a pediatric ED.[8] We did not account for the timing of each individual resident's rotation through the ED. This may have resulted in seasonal variation affecting the type of experience and number of diagnoses recorded by each resident. Finally, residents may have been exposed to the various disorder categories in settings other than the pediatric ED or as part of group education around a single patient.

Conclusions

Pediatric residents working in one of the busiest pediatric EDs in the country and working 1 month more than the ACGME-recommended minimum did not meet the ACGME requirement for emergency and acute illness experience through direct patient care. These findings highlight the fact that it is insufficient to rely on clinical exposure alone to achieve the comprehensive experience desired by the ACGME. Additional educational means are necessary to produce pediatric residency graduates proficient in recognizing and treating emergency and acute illness regardless of the number and assortment of patient exposures in any given training program.

Focused and innovative educational experiences targeting deficiencies in training must exist, particularly in the areas we have identified: recognition and management of shock, sepsis, and cardiopulmonary arrest. Particular attention should be paid to those disorder categories unlikely to be encountered sufficiently by residents outside of an ED rotation. These include altered mental status, cardiopulmonary resuscitation, shock, respiratory failure, and major trauma. Alternative educational experiences to consider include high-fidelity simulation, mock codes, video review of actual cases, and case-based teaching sessions.

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