

1 *Defining a focused Pediatric Emergency Medicine*
2 *curriculum for Emergency Medicine Residents, a*
3 *case study at Michigan Medicine*

4 Running title: Defining Pediatric Emergency Medicine Curriculum

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Abstract

Objectives: Emergency Medicine (EM) is dedicated to the treatment of urgent and emergent illness requiring physicians to evaluate, treat and diagnose patients of all ages. EM residency provides the foundation of knowledge enabling trainees to care for any patient. However, specific pediatric curriculum guidance from governing bodies is limited. The literature includes two potential curricula that are cumbersome to implement. Our primary objective was to identify the components of this curricula which were specific to pediatric emergency medicine (PEM). Secondary objectives were to provide a methods framework and to compare the results with the American Board of Emergency Medicine Model of Clinical Practice (EM Model). Methods: Using the modified Delphi technique, iterative rounds of expert panels sought to reach consensus on PEM specific topics. We utilized the published curricula as the foundation and focused this list using a group of local experts. Predetermined consensus was defined as 80% agreement. Results: The literature derived list of 190 topics were reviewed by the expert panel. Experts identified 92 PEM specific topics and the remaining 98 topics were deemed adequately covered by general EM curricula. All topics reached consensus after three rounds. The final list was sorted in accordance with the EM Model categories. Redundant topics were consolidated resulting in 68 PEM topics. Of these 68 topics, we identified 20 topics (5 of which are critical) that were incompletely covered by the EM Model. Conclusions: EM residency programs should focus their PEM curriculum by deliberately assessing their coverage of key PEM topics. The methods of this study can be replicated to yield locally applicable results in other EM programs.

29 Additionally, the next iteration of the EM Model of Clinical Practice should inform their PEM
30 topics from the available curricula in the literature.

31

32 Introduction

33 Over 80% of children requiring emergency care are seen in general emergency departments by
34 emergency medicine (EM) physicians without pediatric emergency medicine (PEM) fellowship
35 training. [1] Pediatric patients have critical differences in physiology, disease processes and
36 management. Thus, EM physicians must deliberately prepare to care for pediatric patients. [2]
37 The Accreditation Council for Graduate Medical Education (ACGME) states that EM residents
38 must care for patients “at the extremes of age”, complete at least one month of pediatric critical
39 care, and have dedicated pediatric exposure.[3] The American Board of Emergency Medicine
40 (ABEM) outlines the relative importance of topics on the certification exam in the Model of
41 Clinical Practice (EM Model); current guidelines state pediatrics will be a minimum of 8% of the
42 exam. [4, 5] However, clear curricular recommendations are lacking. In an effort to better define
43 a PEM curriculum for EM residents, Mitzman et al. developed a list of PEM curriculum topics,
44 skills and experiences.[6] The authors concluded that their comprehensive curriculum provides
45 a starting point for program directors, but would have to be adapted to individual EM residencies
46 prior to implementation. Their list of topics overlaps with general EM topics. We sought to
47 identify which topics from their list needed a dedicated PEM didactic curriculum in our
48 residency by engaging our local experts in a Delphi process. We also outline our process here to
49 demonstrate how other programs can utilize a similar process for their site. Finally, we compare
50 our list of PEM specific curriculum topics to the EM model in order to identify important PEM
51 topics that may be missing from curricula from EM residencies using this as their sole source of
52 guidance for curriculum design.

53

54 Methods

55 Study Design The Delphi process is a validated method to determine expert consensus using
56 iterative rounds of consensus building.[7] It represents an evidence-based approach to curriculum
57 design. [8-10] We implemented a multi-round Delphi process to determine local expert

58 consensus on PEM specific topics needing dedicated didactic sessions in our EM residency,
59 chosen from a previously developed comprehensive PEM curriculum. We allowed for as many
60 rounds as necessary to reach our a priori-defined threshold for consensus (80% agreement).
61 Characteristics of our Delphi process included selection of an appropriately sized group of
62 experts, performance of iterative rounds, maintenance of anonymity and opportunities for
63 panelist to generate content. All rounds were completed asynchronously via online responses.
64 The Institutional Review Board determined this study to be exempt.

65 Selection of Expert Panelists The expert panel consisted of 10 faculty who are board certified in
66 PEM (6), EM (6), and pediatrics (4). Additionally, all faculty serve as program directors of the
67 EM residency, PEM fellowship, or hold other educational leadership positions. Five members
68 have advanced training in medical education. These local experts were chosen for their in-depth
69 knowledge of our local training environment.

70 Study Protocol The original list of topics as developed by Mitzman et al. is a comprehensive list
71 of PEM topics that overlap with general EM topics, distinguishing these is essential to avoid
72 redundancy in didactic planning. This comprehensive list was reviewed by the research team
73 and a preliminary designation of “PEM specific topic” or “General EM topic” was made for each
74 topic using the following definitions:

75 PEM topic: these topics are specific to the pediatric population or have clinically
76 significant differences in diagnosis or management (e.g. pyloric stenosis - this occurs
77 only in the infant age group or pediatric sepsis - underlying differences in physiology
78 lead to distinctly different management).

79 EM topic: these topics have similar underlying pathophysiology and treatment
80 between adults and pediatrics; thus, could be included as part of a teaching session on
81 the topic (e.g. anaphylaxis - though there are slight variations, the foundation of
82 treatment and diagnostic criteria are the same for all ages).

83 These preliminary designations formed the basis of the Delphi response instrument for round 1.
84 The instrument was piloted for content and clarity with 18 physicians not involved in our study,
85 during a medical education seminar. We sought to maintain content and process response
86 validity through these methods.

87 Round 1 The lists of PEM specific and general EM topics were given to the expert panelists
88 electronically. Experts were each asked to agree or disagree with the preliminary designation
89 (PEM specific vs. general EM) for each topic. Additionally, they were asked if there were any
90 necessary PEM topics not included on the original list. Results were analyzed and topics were
91 categorized as: PEM topics with consensus, EM topics with consensus and topics without
92 consensus.

93 Round 2 In round 2, experts were anonymously fed back the PEM and EM topics which had
94 reached consensus and asked to confirm agreement. For the topics that did not reach consensus,
95 experts were again asked to designate the topic as PEM or EM and provide a written
96 justification. Results were analyzed and topics were categorized as PEM specific or general EM
97 based on the previously described definition of consensus. For those items that did not reach
98 consensus, free text responses were analyzed and coded; categorization was adjudicated by the
99 authors, consistent with methods for an in-person Delphi process.

100 Round 3 Experts were anonymously fed back the list of PEM and EM topics that reached
101 consensus and asked to confirm their agreement.

102

103 Results

104 Nine of ten invited experts participated in the Delphi process. Panelists started with the original
105 190 topics identified by Mitzman et al., presorted by the research team into PEM specific and
106 general EM topics. Following the first round, consensus was met on the classification for all but
107 16 topics. During round 2, the remaining topics were categorized based on panel consensus, or
108 by author adjudication based on analysis of free text comments from the panelists. Round 3 was
109 performed to allow expert review and consensus was confirmed. This resulted in 92 PEM
110 specific and 98 general EM topics. The experts did not identify any additional topics not
111 included on the original list.

112 In order to compare our list of PEM specific topics to the EM model, we first reviewed the 92
113 PEM topics and condensed them as appropriate based on author judgement of redundancy. For
114 example, “chest tube placement on infants” and “chest tube placement on young children” were
115 combined. Table 1 depicts our results sorted by the EM model categories [4], with redundant

116 topics denoted by a “*”. This resulted in a final PEM curriculum of 68 topics, which represents
117 the final list of PEM specific topics identified for our EM residency program. When compared
118 with the EM model, 20 of our identified PEM specific topics are not adequately covered in the
119 EM model (denoted by “§” in Table 1).

120

121 Discussion

122 Using a modified Delphi method, with a previously developed comprehensive PEM curriculum
123 as a starting point, our local EM education experts were able to identify 68 topics that require a
124 focused PEM curriculum in our residency program. This manageable amount of content should
125 be incorporated into an existing EM curriculum. While our list is likely influenced by
126 idiosyncrasies of our training program, our methodology is easily replicated to yield site specific
127 results. Program directors could replicate these methods in order to ensure they are covering key
128 PEM topics and ensure that their general EM didactics cover the nuances of pediatric
129 emergencies. Local experts can be EM, Peds/PEM, EM/PEM trained and should include
130 individuals involved in didactic education. Those with advanced training in medical education
131 should be included and assist in this process.

132 Importantly, our process identified 20 PEM topics not adequately covered in the most recent
133 version of the EM Model. In particular, five of these topics have distinct management and high
134 risk of morbidity: recognition of pediatric heart failure, postoperative congenital heart disease,
135 neonatal hypoglycemia, congenital adrenal hyperplasia shock in neonates and small dose
136 ingestions dangerous to toddlers. We suggest that based on our results here, as well as the
137 previous work by Mitzman et al., that these topics should be considered for addition or
138 modification in the development of the next model.

139 Limitations

140 The Delphi process is limited by unconscious bias. To mitigate this, we included a diverse panel
141 of experts. Another limitation is that the results reflect our institutional environment. However,
142 this process can be replicated at other EM training programs. Our study was limited by survey
143 response rate due to family leave and leadership transitions. Despite this we maintained
144 participation of greater than 70% for the first two rounds. The third round had 90% participation

145 to confirm consensus. The single expert who did not participate in round 3, did not participate in
146 any of the prior rounds, thus all our available experts agreed upon final topic designation.

147

148 Conclusions

149 Using a robustly developed, previously published, comprehensive PEM curriculum for EM
150 residency programs as the foundation, we were able to identify a manageable list of 68 PEM
151 specific topics that require dedicated teaching in our EM residency program. Other EM training
152 programs could consider following a similar process in planning their curricula in order to ensure
153 adequate PEM education for their trainees.

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1. Signs, symptoms & presentations	2. Abdominal and GI	3. Cardiovascular	4. Cutaneous	5. Endocrine, metabolic and nutrition	7. HEENT	8. Hematologic	9. Immune system	10. Systemic Infections	11. Musculoskeletal	12. Nervous system	14. Psycho/behavioral	16. Thoracic-Respiratory	17. Toxicologic	18. Trauma	19. Procedures and skills	20. Other core competencies
Recognize a sick child	Intussusception	Neonatal congenital cardiovascular presentations	Recognize and manage-Henoch-Schonlein purpura	Acute DKA and hyperglycemia	Acute otitis media (including high dose amoxicillin) *	Recognition of emergencies in febrile sickle cell disease*	Know signs and symptoms of Kawasaki's disease	Pediatric sepsis [§]	Musculoskeletal injuries by age (including Salter-Harris and nursemaids) * [§]	Febrile seizures	Abuse and neglect - recognition, diagnosis, evaluation, and resources*	Assessing child for aspirated foreign bodies	Diagnosis and stabilization involving small dose ingestions dangerous or fatal to toddlers[§]	Management and diagnosis of pediatric C-spine injury* [§]	Intubation and airway management of pediatric patients* [§]	Laws pertaining to medical personnel responsibility for child abuse and neglect
The approach to the febrile or septic neonate	Malrotation/volvulus	Idiopathic hypertrophic subaortic stenosis (hypertrophic cardiomyopathy)		Neonatal hypoglycemia[§]	Management of ocular emergencies-tips and tricks for exam	Recognition of uncommon but serious hematologic disorders		Persistent fever over 7 days [§]	Key decision rules-Kocher criteria for septic joint	Age appropriate neurologic assessment [§]	Psychosocial differences based on developmental milestones* [§]	Lung disease of prematurity*		Common traumatic conditions - blunt abdominal trauma	Establish rapport and perform an exam on patients of varying ages and cooperation* [§]	General administrative, legal and ethical issues involved with treating children in an ED
Diagnosis of children with a pediatric/toddler limp	Management of necrotizing enterocolitis (medical and surgical) *	Recognition of pediatric heart failure[§]		CAH shock in neonates[§]	Foreign-body removal - nose or ear*	Leukemia		Knowledge of vaccination schedules and disease* [§]	Slipped capital femoral epiphysis	Manage special-needs children-cerebral palsy [§]	Manage special-needs children-autism [§]	Treatment of acute presentations of cystic fibrosis		Pediatric burn management	Neonatal resuscitation and procedures*	
Vital sign, physiologic and anatomic differences by age group* [§]	Pyloric stenosis	Myocarditis									Diagnosis and management of sexual abuse	Asthma		Application of head CT rules* [§]	Application of rules for fluid resuscitation (bolus and maintenance) * [§]	
Jaundice	Ingested foreign bodies	Postoperative congenital heart disease child[§]										Branchiolitis			Pediatric trauma resuscitation	
Red stool [§]	Meckel's diverticulum											Croup			Chest tube placement in pediatrics* [§]	
Vomiting-by age group	Biliary atresia [§]														How to take a pediatric history* [§]	
Constipation															Lumbar puncture in neonates [§]	
															Pediatric dosages antipyretics* [§]	
															Pediatric dosing for resuscitation medications* [§]	
															Pediatric dosage of sedation medications* [§]	

Table 1 – Targeted needs assessment Pediatric Emergency Medicine topics sorted by EM Model category. Categories 6, Environmental, 13, OB/gynecology, and 15, GU/renal were omitted as there were no topics in the category.
 * topic combined or condensed for ease of use
 § topic incompletely covered by EM model
bold/underline topics not covered by EM Model that are critical for EM physicians