A Research Agenda to Advance Pediatric Emergency Care Through Enhanced Collaboration Across Emergency Departments

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ABSTRACT

In 2018, the Society for Academic Emergency Medicine and the journal *Academic Emergency Medicine* (*AEM*) convened a consensus conference entitled, "*Academic Emergency Medicine* Consensus Conference: Aligning the Pediatric Emergency Medicine Research Agenda to Reduce Health Outcome Gaps." This article is the product of the breakout session, "Emergency Department Collaboration-Pediatric Emergency Medicine in Non-Children's Hospital").

This subcommittee consisting of emergency medicine, pediatric emergency medicine, and quality improvement (QI) experts, as well as a patient advocate, identified main outcome gaps in the care of children in the emergency departments (EDs) in the following areas: variations in pediatric care and outcomes, pediatric readiness, and gaps in knowledge translation. The goal for this session was to create a research agenda that facilitates collaboration and partnering of diverse stakeholders to develop a system of care across all ED settings with the aim of improving quality and increasing safe medical care for children. The following recommended research strategies emerged: explore the use of technology as well as collaborative networks for education, research, and advocacy to develop and implement patient care guidelines, pediatric knowledge generation and dissemination, and pediatric QI and prepare all EDs to care for the acutely ill and injured pediatric patients. In conclusion, collaboration between general EDs and academic pediatric centers on research, dissemination, and implementation of evidence into clinical practice is a solution to improving the quality of pediatric care across the continuum.

According to a 2014 Centers for Disease Control and Prevention report, there are approximately 141 million emergency department (ED) visits per year in the United States. Of those, an estimated 27

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Received July 2, 2018; revision received October 6, 2018; accepted October 10, 2018.
Presented at the *Academic Emergency Medicine* Consensus Conference, Indianapolis, IN, May 15, 2018.
Funding for this conference was made possible in part by grant 1R13HS026101-01 from the Agency for Healthcare Research and Quality (AHRQ), Patient-Centered Outcomes Research Institute (PCORI; Eugene, WA) Engagement Award EAIN-6161, and Health Resources and Services Administration (HRSA) Emergency Medical Services for Children (EMSC) cooperative agreement 6 U03MC288450303. The views expressed in written conference materials or publications and by speakers and moderators do not necessarily reflect the official policies of the Health Resources & Services Administration (HRSA), Department of Health and Human Services (HHS), PCORI, or the U.S. Government nor does mention of trade names, commercial practices, or organizations imply endorsement by the U.S. Government.
The authors have no relevant financial information or potential conflicts to disclose.
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ACADEMIC EMERGENCY MEDICINE 2018;25:1415–1426.

doi: 10.1111/acem.13642
ISSN 1553-2712

million visits were for children under 15 years of age (20% of all ED visits).[1] The approximately 5,000 EDs in the United States vary in their pediatric patient volume, and the overwhelming majority of EDs are general EDs, which provide care to both adults and children, in contrast to pediatric EDs, which provide care primarily to children. Overall, 85% of pediatric visits to EDs are to general EDs with varying pediatric volumes.[2]

General EDs face many challenges in caring for pediatric patients (e.g., conflicting demands on time and limited resources), which may lead to variations in pediatric care and patient outcomes between general and pediatric-specific EDs. For example, with respect to practice variation, the use of plain radiographs for respiratory diseases (asthma, bronchiolitis, and croup) is significantly lower in pediatric-specific EDs than in general EDs.[3,4] Similarly, a recent study evaluating imaging radiation exposure in patients with non–trauma-related abdominal complaints revealed lower computed tomography (CT) use in pediatric-specific EDs than in general EDs (odds ratio [OR] = 0.34, 95% confidence interval [CI] = 0.17–0.69) and higher ultrasound use in pediatric-specific EDs (OR = 2.14, 95% CI = 1.29–3.55).[5] In terms of patient outcomes, mortality is the ultimate outcome that differs by type of ED. Children with atraumatic out-of-hospital cardiac arrest have higher survival in pediatric EDs than general EDs (33.8% vs. 18.9%, $p < 0.001$) with an adjusted OR of survival in pediatric ED compared to general EDs of 2.2 (95% CI = 1.7–2.8).[6] Other studies have shown similar findings, with halved mortality rates in very high pediatric volume EDs (≥50,000 annual pediatric visits per year) compared with low-pediatric-volume EDs.[7]

Limited resources in EDs negatively impact pediatric readiness. The Emergency Medical Services for Children (EMSC) program has developed an ongoing quality improvement (QI) project to improve ED pediatric readiness in the United States, starting with the development of a survey that assigns an ED a pediatric readiness score out of 100. A national survey in 2013 showed that 86.3% of EDs see fewer than 28 children per day (<10,000 per year) and that pediatric readiness correlates with pediatric visit ED volume. For EDs with low-pediatric-visit volume (fewer than 1,800 pediatric visits per year or fewer than five children per day), the median pediatric readiness score was 68.9; in contrast, EDs with high-pediatric-visit volume (>10,000 visits per year) had a score of 89.8.[2]

In addition to conflicting demands and limited resources multiple other factors may contribute to the variability in pediatric care across practice settings. The lag in translation of scientific evidence to clinical practice for instance, a well-recognized problem in health care, may be more pronounced in general EDs than in pediatric-specific EDs when it comes to advances in the care of pediatric emergency patients. Many general EDs commit resources to meeting publicly reported indicators that address adult measures and may have limited resources to address pediatric quality measures. In addition, the availability of specific pediatric skills and resources in general EDs may limit the application of new knowledge for treatment of pediatric patients. Similarly, pediatric medical events such as cardiac and/or respiratory arrests occur infrequently in lower-pediatric-volume EDs, creating challenges in preparation for such rare events. Finally, the majority of pediatric emergency medicine (PEM) research and knowledge generation occurs in EDs associated with academic centers or children's hospitals.

The studies outlined above illustrate the gaps in the care of children in the ED. The lack of collaboration has negatively impacted resources, pediatric readiness, and knowledge dissemination to achieve the optimal care of children in the ED. This consensus conference offered a unique opportunity to create a research agenda that facilitates partnering of diverse stakeholders to develop a system of care across all ED settings with higher quality and increasingly safe care for children.

METHODS

General Approach and Methods Used for Consensus Generation

Over a 2-year period, the ED collaboration subcommittee, composed of a patient advocate, experts in emergency medicine practicing in EDs with different pediatric volumes, PEM, and simulation and practitioners with expertise in PEM quality, worked to identify for the *Academic Emergency Medicine* (*AEM*) consensus conference key areas of potential research in advancing collaboration in PEM. These areas of research address the goal of "understanding the complex interactions and the need for collaboration among the different types of emergency departments and providers caring for acutely sick and injured pediatric patients."

Following an extensive review of the literature to identify the current state of pediatric emergency care in general EDs, the subcommittee developed topics for future research, identifying clinically relevant research topics with the greatest potential impact. This resulted in the development of a list of four themes with associated questions (described under "Challenges to Creating a Research Agenda on Improving Pediatric Care in General EDs") for discussion at the consensus conference. These themes and questions were further refined by soliciting the input of stakeholders outside of the subcommittee prior to the conference using a Qualtrics survey. These stakeholders included conference registrants and members of the American Academy of Pediatrics (AAP) Section on Emergency Medicine, EMSC, American College of Emergency Physicians (ACEP) Pediatric Emergency Medicine Committee, and Pediatric Emergency Care Applied Research Network (PECARN). There were a total of 178 responses.

At the *AEM* consensus conference, committee members and approximately 115 participants assembled for the final phase of the consensus process. The breakout session took place over a period of 105 minutes with approximately 55 participants. The group was divided into four smaller subgroups, each one moderated in a similar format, involving brainstorming and prioritization of solutions using the KJ Method.[8] This process resulted in consensus recommendations and suggested strategies for future investigators.

STATEMENT OF OUTCOME GAPS

The main outcome gaps identified include variations in pediatric care and outcomes across EDs, gaps in knowledge translation, and limitations in pediatric readiness. For example, over the past few decades general EDs have made improvements in having pediatric-specific supplies and equipment; however, they may still have limited pediatric-centered staff and equipment and lack policies, procedures, and training specific to pediatrics.[2,9] Higher total pediatric volume and the presence of a physician and/or nurse pediatric emergency care coordinator (PECC) are associated with an ED's readiness to care for children.[2] The lack of collaboration negatively impacts the readiness of all EDs to care for children.

Similarly, although there has been a trend toward regionalization in pediatric care, with pediatric patients often being transferred from general EDs to pediatric centers, the question remains of the actual need to transfer noncritical pediatric patients. In one study of children who were transferred to a pediatric center from a general ED, 25% of non–critically ill children were discharged directly from the receiving ED, and 17% were admitted for less than 24 hours after transfer.[10] This study illustrates how the lack of collaboration between the transferring general EDs and the accepting institution negatively impacts the care of children. Additional thought must be provided to engaging general EDs in contributing to and translating pediatric-specific evidence generated primarily in academic pediatric centers to the bedside to improve pediatric outcomes across EDs.

CONCEPTUAL FRAMEWORK AND CREATION OF THE RESEARCH AGENDA

The conceptual framework for the research agenda should distinguish between three distinct but interrelated types of outcomes: implementation, quality, and patient outcomes. It is essential that all stakeholders recognize the importance of general EDs in providing pediatric emergency care and the need for collaboration as a solution to improve care across all EDs.

Implementation

It is important to not only collect information regarding the care of pediatric patients in general EDs but also to provide feedback on outcomes and benchmarking to strive for best practices. A multitude of ongoing initiatives (Data Supplement S1, available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1111/acem.13642/full) is making progress through the development of resources, measurement tools, standards, and requirements. In addition, collaboration has been evident in some pediatric-specific hospitals creating programs over the past decade involving innovative models in the ED (e.g., partnership in staffing general EDs and sharing policies/procedures, health system–based networks of pediatric emergency care), educational outreach, telemedicine, and use of simulation.[11–17]

For example, a Canadian network, TRanslating Emergency Knowledge for Kids (TREKK), has completed a series of projects to improve emergency care across all EDs by developing pediatric resources available to all settings. The group has identified

the preferred topics and methods of delivery for content by general ED providers and have created online resources in collaboration with these frontline providers.[12]

Another specific example of a collaborative QI project designed to promote the optimal care of children in EDs in the United States and all U.S. territories is the National Pediatric Readiness Project (NPRP) "Peds Ready."[18–21] The implementation of Peds Ready in low- to medium-volume EDs has been challenging. The most common barriers identified to implementing national guidelines are cost of training and lack of educational resources.[2] Therefore, the research agenda should focus on how collaboration between general EDs and their associated pediatric centers may support the training and engagement of PECCs, help overcome barriers to the adoption of Peds Ready, engage all EDs in process improvement and establish a benchmark that measures ED improvement over time. Currently, the EMSC Innovation and Improvement Center (EIIC) has started the Pediatric Readiness Quality Collaborative involving more than 140 hospitals EDs that could answer some of these research questions.

There are a variety of ongoing initiatives as well through AAP, ACEP, Emergency Nurse Association, American Academy of Family Physicians, the American Academy of Physician Assistants, the National Organization of Nurse Practitioner Faculties, EMSC, EIIC, NPRP, PECARN, and grass roots organization such as CALS (Comprehensive Advanced Life Support) to create pediatric resources. These groups must work with frontline stakeholders to develop and test systems of care that allow for optimization of quality across the continuum.

Additionally, investigators must always consider the generalizability of work that is conducted in larger academic centers to the broader community of practice in general EDs that care for most children. The PECARN head injury rule is an excellent example of effective knowledge translation/dissemination using decision support in the electronic medical record (EMR), apps as cognitive aids, and social media campaigns including the "Think-A-Head" movement from the Image Gently Alliance.[22,23]

Quality Measures

Pediatric-specific measures and implementation processes must be developed to ensure continuous QI to reduce errors, improve safety, and reduce variations in care, with the ultimate purpose of improving systems' ability to optimize patient outcomes. It is important to integrate these initiatives within the broader scope of emergency medicine care. The PECARN has developed and validated instruments to evaluate the quality of care delivery in pediatric care by using implicit review methods that can be used for diverse groups of patients.[24,25] A recent study used this implicit review methods tool to look at patient-level factors and the quality of care in 12 PECARN EDs and found that some chief complaint categories were associated with significantly lower than average quality of care, including fever (–0.65 points in quality, 95% CI = –1.24 to –0.06) and upper respiratory symptoms (–0.68 points in quality, 95% CI = –1.30 to –0.07).[26] The concern with current measures related to pediatric emergency care is the lack of a systematic and comprehensive approach. The quality agenda cannot be separated from implementation of these quality measures and should address the following outcomes suggested by Peds Ready: acceptability, adoption, appropriateness, feasibility, fidelity, cost, penetration, and sustainability.[27]

Patient Outcomes

The ultimate goal of the research agenda is to improve patient outcomes and provide high-quality care across all ED settings, which in turn is dependent on provider training, collaboration among the different stakeholders, developing and disseminating evidence-based knowledge to care for children that is sustainable in any ED setting,[28] development of QI initiatives, and the measurement of quality of the care provided.

RESEARCH PRIORITY/AGENDA ITEMS

Goals

The goals were to include all EDs in creating a research agenda to advance the quality and safety of pediatric emergency care across all EDs, understand the challenges, and enhance collaboration among EDs to achieve optimal health outcomes.

Objectives

- Create best practices for developing a system of care for general EDs and those in pediatric EDs to collaborate and focus on solutions to close the gap on safety, quality, and evidence-based practice in a patient/family-centered setting. This system should

meet the needs of both groups to provide the best clinical care for pediatric patients.
- Develop pediatric-specific outcome measures and implementation processes to ensure continuous QI.
- Evaluate ED preparedness and readiness to provide emergency care for children and its effect on patient outcomes.

These objectives lead to four themes with questions associated with each theme. The questions were prioritized prior to the consensus conference via a Qualtrics survey and are listed under each theme in Table 1 from highest to lowest priority.

Themes

I. Identify solutions to the challenges and barriers in developing a system of care in general EDs to provide safe and quality care for children.
II. Enhance collaboration between general EDs and pediatric-specific EDs when developing national guidelines and standardizing care.
III. Study the quality of care provided to children in EDs in the United States.
IV. Evaluate national pediatric readiness and its effects on patient outcomes.

During the breakout session, the subgroups for each theme addressed the first two to three questions that the premeeting survey had identified as top priorities. Using the KJ method, the group collaboratively brainstormed, categorized, and prioritized ideas for future investigations into those topics.[8] This process resulted in consensus recommendations and suggested strategies for future investigators, which are listed in detail in Table 2.

CHALLENGES TO CREATING A RESEARCH AGENDA ON IMPROVING PEDIATRIC CARE IN GENERAL EDS

To create a research agenda to improve care in general EDs, it is essential to appreciate the challenges and barriers to establishing and implementing such an agenda. These challenges are significant, and to proceed with the formation of a research agenda without addressing the difficulties in moving forward puts successful implementation of this agenda at risk.

The PEM community is at the core of establishing this research agenda, articulating both the content and the methodology for implementation. It is clear that the vast majority of U.S. children are seen in general EDs, which have a wide variation in pediatric visit volumes. Because pediatric visits comprise only 20% of a general ED's patient volume, more resources may be directed toward the care of adults.

At its core, understanding how to help smaller-pediatric-volume EDs improve pediatric care will require the PEM community to create a research agenda that establishes potential value for all EDs and will clearly involve partnering with the leadership of general EDs. Equally important is the need to share data across regions and provide benchmarking to improve care in all EDs as well as to then establish research priorities and interventions that improve pediatric outcomes.

A necessary starting point may be research aimed at understanding more about these challenges. Some preliminary questions might be:
- How do EDs with a low volume of pediatric patients view pediatric care? Is there interest in focusing on such care? If not, why not?
- What are their perceived barriers to focusing on pediatric care?
- What are their perceived incentives to focusing on pediatric care?
- What kinds of resources/training would they find of most benefit?

In summary, a traditional "top-down" approach, in which a research agenda is created by the pediatric academic community to improve care at general EDs, is unlikely to succeed. A more successful starting point would be an emphasis on understanding some of the basic challenges of pediatric emergency care in general EDs, where adult patients command the majority of leadership's attention, and understanding the need for active collaboration and partnership among the different stakeholders.

CONCLUSION

In conclusion, since the majority of acutely ill and injured pediatric visits in the United States are to general EDs, but most research is conducted in pediatric hospitals, providers in both settings must collaborate in their research efforts to improve care of children nationwide. Four key themes emerged from the 2018 Society for Academic Emergency Medicine Clinical Consensus Conference breakout session: Enhancing collaboration in pediatric emergency care

Table 1
Main Themes Identified and Associated Questions

Theme	I. Identify solutions to the challenges and barriers to developing a system of care in general EDs to provide safe and quality care for children.	II. Enhance collaboration between general EDs and pediatric-specific EDs when developing national guidelines and standardizing care.	III. Study the quality of care provided to children in EDs in the United States.	IV. Evaluate national pediatric readiness and its effects on patient outcomes.
Associated questions	1. How can we leverage technology, e.g., telehealth and "virtual EDs," to disseminate ideas, improve communication, and facilitate teamwork to provide patient centered care? 2. How can we establish collaborative networks to advance education, research, and advocacy for pediatric patients taken care of in all EDs? 3. Should we create financial incentives for general EDs to prioritize resources on pediatric care? How do we link outcomes and payment to care received by pediatric patients in general EDs (incentives to not transfer)? How do we change the transfer culture to view as partnership between hospitals? 4. How can pediatric subspecialty consultation be improved in general EDs? 5. How can the challenges that prevent PEM physicians in larger health care systems to decentralize their efforts between the children's hospitals and general EDs be evaluated? 6. What is the feasibility of a national poison control model for PEM consults? How would these be organized and funded?	1. How can guidelines developed in pediatric hospitals be translated to EDs without pediatric inpatient units/pediatric intensive care units? 2. How can providers in general EDs be engaged in developing clinical guidelines so that they are more relevant and applicable to the care of children in any ED? 3. What is the feasibility of creating an online database for management algorithms (short, intervention-based and universally applicable)? 4. Use of simulation for low-volume/high-acuity conditions and teamwork: How would simulation be implemented, and how would the impact of just-in-time training of low-frequency procedures in low-pediatric-visit-volume EDs be studied? 5. What type of pediatric emergency care research needs to be conducted in general EDs? 6. Additional suggestion by survey participants: Use of integrated EMR to implement standard of care guidelines for common pediatric emergency presentations.	1. How can pediatric-specific quality measures be implemented in all EDs? 2. How can the creation and maintenance of a QI program in low-volume EDs with limited resources be facilitated? 3. How can a process for data collection be established on quality indicators across the spectrum of ED settings that provide care for children? 4. How can general EDs get involved in the process of developing pediatric specific measures and contribute to work being done by ACEP through the Clinical Emergency Department Registry and the AAP Section on Emergency Medicine Quality Transformation? 5. Additional suggestion by survey participants: How can QI collaboratives be used to support identification of quality measures, data collection, and impact on outcomes across a wide variety of EDs?	1. What is the best way to prepare general EDs to care for pediatric patients? 2. What is the role of a PECC for EDs and what is the effect of PECC on patient care, quality markers, and patient outcomes? 3. Does identifying providers to serve as "pediatric champions" introduce best pediatric practices into the general EDs? 4. How can information on "pediatric readiness" be disseminated and key stakeholders educated about its implementation?

AAP = American Academy of Pediatrics;
ACEP = American College of Emergency Physicians; EMR = electronic medical record; PECC = pediatric emergency care coordinator; PEM = pediatric emergency medicine; QI = quality improvement.

Table 2
Consensus Recommendations and Suggested Strategies for Future Investigators

Theme	Questions Addressed	Consensus Recommendations	Strategies for Future Investigators
I	1. How can we leverage technology, for example, telehealth and virtual EDs, to spread ideas, improve communication, and facilitate teamwork to provide patient centered care, where "the right care is provided to the right patient at the right time and at the right place?"	• "Virtual EDs" and telemedicine could facilitate collaboration between PEM content experts and general EDs using "just-in-time" capability for challenging diagnoses and management of acutely ill and injured children.	• Perform needs assessment of target stakeholders. • Transition to system that provides mentorship and partnership in knowledge exchange, potentially utilizing technology (virtual ED" telemedicine, EMR-based clinical decision tools). ◦ Evaluate best model for operational implementation. ◦ Explore concerns related to reimbursement and liability. ◦ Address outcomes whenever possible (e.g., inappropriate transfers to pediatric-specific facilities, patient/family experience, provider satisfaction).
	2. How should we establish collaborative networks to advance education, research, and advocacy for pediatric patients in all EDs?	• Leverage existing networks such as PECARN, EMSC, and professional organizations (e.g., ACEP, AAP, AAFP, etc.) at both state-chapter and national levels. • Work with regional health systems to advance implementation and translation of knowledge to facilities providing pediatric emergency or urgent care services. • Form state-based PECC networks.	• Define key stakeholders and perform a needs assessment of general EDs. • Explore collaboration with existing networks to advance research in implementation of evidence-based care guidelines. • Evaluate state-based PECC networks' effect on adherence to existing quality measures and role in development of novel evidence-based quality measures. • Expand the concept of EDs approved for pediatrics to all EDs, *requiring* all EDs to meet minimum requirements for pediatric readiness, rather than being given the option to opt out. ◦ Record and evaluate outcomes. ◦ Develop a system similar to CMS measures for adults to link achievement of certain pediatric care targets, quality measures, and outcomes to reimbursement. ◦ Establish a national database of pediatric outcomes to assess readiness and quality of care, considering funding through a federal–state–industry partnership, similar to the Kids' Inpatient Database, a set of pediatric hospital inpatient databases included in the Healthcare Cost and Utilization Project family.
II	1. How do we translate guidelines typically developed in pediatric hospitals to hospitals without pediatric inpatient units or PICUs?	• PEM content experts should collaborate with local pediatric champions in general EDs in their region to reach consensus on best practices to implement specific diagnostic and management strategies for children.	• Perform a needs assessment to determine which components of treatment and diagnosis in general EDs are amenable to guidelines (such as over- or undertreatment and diagnostic error). • Examine barriers to implementation of guidelines in general EDs and pursue strategies to inspire interest in PEM and collaboration with PEM experts. • Explore strategies to facilitate development or adaptation of guidelines within general EDs that will lead to eventual adoption and sustained utilization, studying: ◦ Whether it is higher yield for the PEM expert and local champion to create, implement, and evaluate guidelines together or rather to involve the local champion in tailoring, implementing, and evaluating previously existing guidelines. ◦ How to get buy in from leadership and how a top-down strategy for eliciting support compares with one from the ground up. ◦ Whether or not receiving feedback from receiving pediatric EDs leads to a change in clinical practice. ◦ What the effect of implementing guidelines within an EMR has on ease of guideline use and overall job satisfaction.

(Continued)

Table 2 (continued)

Theme	Questions Addressed	Consensus Recommendations	Strategies for Future Investigators
	2. What is the optimal path for PEM knowledge generation and dissemination in general EDs?	• PEM research related to knowledge generation and dissemination should involve general EDs in addition to pediatric EDs.	• Perform a needs assessment to determine general EDs' interest in, and capacity for, participation in research, asking: ○ What is the optimal research role for general EDs (e.g., study design and implementation, sharing data, analyzing data)? ○ How can existing PEM research infrastructure best support general EDs? ○ What are feasible methods for performing research in a general ED setting? • Explore whether research involving general EDs should focus on knowledge generation, dissemination, or both. • Investigate how engagement in existing local and national quality initiatives can be leveraged as research. • Examine how bidirectional research partnerships between general EDs and existing drivers of PEM research (e.g., university researchers, legislators, insurance companies) can best be established and sustained.
III	1. What is the best way to understand the resources and capabilities of community EDs compared to their patient needs?	• PEM QI networks should further study general EDs, including the resources and capabilities available to support pediatric QI efforts and patient needs within these communities.	• Leverage NPRP data to identify PECC presence and investigate existing linkages to local and regional quality networks. • Explore barriers to data acquisition and evaluation, as well as implementation, including: ○ Lack of pediatric champions or PECCs. ○ Varying degrees of hospital support for pediatric QI. ○ Misaligned financial incentives and support for developing pediatric QI programs.
	2. How can pediatric QI measurement be implemented in all EDs?	• Reporting of quality metrics in EDs should be automated through the EMR and other data collection mechanisms to decrease the burden of manual chart review. • Quality metrics should be developed only if broadly applicable and achievable across the spectrum of emergency care. • Metric development should include general ED stakeholders, recognizing barriers to implementation.	• Identify simple achievable patient measures with broad consensus. • Form linkages for general EDs with more pediatric resource rich institutions. • Provide bidirectional feedback for success and larger cohort effectiveness of the program. • Explore regulatory mandates and support for developing pediatric QI initiatives specific to EDs.
	3. What is the best way to facilitate creation and maintenance of QI programs in low volume EDs with limited resources?	• Creating universal metrics applicable to all EDs and aligning financial incentives will support institutions in developing PEM QI programs.	• Create infrastructure to support measurement and data collection, including investigation into: ○ How to create patient level outcomes reporting. ○ How to create collaborative QI networks. ○ How to best use EMRs and clinical decision support to assist data collection and reporting. • Utilize information exchanges to increase learning. • Report outcomes and opportunities with EDs within these networks in a collaborative manner.

(Continued)

Table 2 (continued)

Theme	Questions Addressed	Consensus Recommendations	Strategies for Future Investigators
IV	1. What is the best way to prepare general EDs to be pediatric ready?	• Increase knowledge related to pediatric care. • Improve communication among all EDs caring for children. • Establish standard work and procedures to improve pediatric care. • Consider financial incentives to increase pediatric readiness of EDs. • Consider the use of technology in pediatric preparedness, which could impact knowledge, skill acquisition, cost, communication among different EDs, and patient-centered care delivery.	• Conduct needs assessment of different types of general EDs, varying in geographic area and pediatric volume. • Education: ◦ Identify a PECC. ◦ Develop easily accessible reference materials and educational tools specific to PEM. ◦ Create standardized management guidelines for common illnesses, sharing practice pathways and toolkits. ◦ Utilize technology to enhance education. ◦ Strengthen technical skills through simulation-based workshops. • Communication: ◦ Create collaborative network between general EDs and pediatric specific EDs either through PECC or through pediatric champions. ◦ Use telemedicine to enhance real-time communication. ◦ Provide a feedback system between general and pediatric EDs. • Standardizing work and procedures: ◦ Develop an established list of equipment, procedures, and guidelines, including: ■ Pediatric medication dosing; ■ Standard vital signs by age; ■ Measuring weight in kilograms; ■ Availability of procedural supplies; ■ Perform regular systematic review of quality of care; ■ Establish principles for pediatric centered care. • Financial considerations: ◦ Employing a child life specialist. ◦ Regularly replacing rarely used pediatric equipment. ◦ Providing financial incentives for general EDs to provide high-quality pediatric care by linking reimbursement with improved patient care outcomes. • Leverage technology to improve clinical care, education, and enhanced collaboration and communication and use EMRs to collect data and use in decision support.

(Continued)

Table 2 (continued)

Theme	Questions Addressed	Consensus Recommendations	Strategies for Future Investigators
	2. What is the role of the PECC?	PECCs should play a major role in ED preparedness for pediatric patients in four domains: • Quality of care ○ Provide QI oversight. ○ Establish benchmarking. ○ Establish process measures. ○ Conduct peer review. ○ Use markers such as: ■ Return visits; ■ Patient complaints; ■ Medical/medication errors; ○ Establish inter-facilities transfer policies. • Clinical care oversight ○ Manage pediatric care issues. ○ Ensure staff adherence to recognizing abnormal vital signs. ○ Ensure the availability and access to pediatric specific equipment in a cost-effective manner. ○ Establish a central area for guidelines, pathways and pediatric policies. ○ Develop protocols for common and life-threatening pediatric diseases. • Education ○ Provide access to evidence-based medicine pathways for all health care professionals caring for children in the ED. ○ Increase availability of continuing education. • Communication ○ Conduct regular meetings with other general EDs and pediatric EDs to streamline processes and enhance communication/knowledge sharing to improve patient outcomes.	Evaluate the effect of PECC on pediatric readiness in the four domains: • Quality of care ○ Percent of PALS-certified nurses. ○ Percentage of pediatric patients with pain assessment within 1 hour of ED presentation. ○ Frequency of return visits (within 24 hours and 30 days). ○ Transfers—e.g., ■ Fewer or more efficient transfers for certain illnesses; ■ Times to transfer to definitive care facility. ○ Standard quality indicators before and after PECC. ○ Improvement of disease-specific measures where greatest gaps in care have been identified. • Clinical care—examples of common diseases to use for evaluation of the effect of PECC included: ○ Asthma exacerbation: e.g., steroids given in a timely fashion. ○ Ultrasound versus CT scan of abdomen for appendicitis. ○ Medication dosing errors. ○ Head and C-spine CT use in trauma patients. ○ Chest radiography use in bronchiolitis. • Education ○ Implementation of evidence-based guidelines. ○ Opportunities provided for skills acquisition and maintenance, particularly for low frequency/lifesaving procedures. • Communication ○ Patient experience (e.g., Press Ganey scores). ○ Collaboration and timely feedback among various EDs to provide high-quality, patient-centered care. ○ Frequency of medical errors.

AAFP = American Academy of Family Physicians; AAP = American Academy of Pediatrics; ACEP = American College of Emergency Physicians; AHRQ = Agency for Healthcare Research & Quality; CMS = Centers for Medicare & Medicaid Services; EMR = electronic medical record; EMSC = Emergency Medical Services for Children; EIIC = Emergency Medical Services for Children Innovation and Improvement Center; NPRP = National Pediatric Readiness Project; PALS = Pediatric Advanced Life Support; PECARN = Pediatric Emergency Care Research Network; PECC = Pediatric Emergency Care Coordinator; PEM = pediatric emergency medicine; PICU = pediatric intensive care unit; QI = quality improvement.

(pediatric emergency medicine practice in non–children's hospitals):

I. Identify solutions to the challenges and barriers in developing a system of care in general EDs to provide safe and quality care for children.
   - Future research should explore use of technology to enhance real-time clinical care between EDs, as well as collaborative networks for education, research, and advocacy.

II. Enhance collaboration between general EDs and pediatric-specific EDs when developing national guidelines and standardizing care.
   - Future research should explore development and implementation of patient care guidelines in general EDs as well as examine pediatric knowledge generation and dissemination in general EDs.

III. Study the quality of care provided to children in EDs in the United States.
   - Future research should study resources and capabilities of general EDs with regard to pediatric patients as well as the feasibility of extending pediatric QI to all EDs.

IV. Evaluate national pediatric readiness and its effects on patient outcomes.
   - Future research should evaluate the best way to prepare general EDs for the care of the acutely ill and injured pediatric patients, including the role of a PECC in advancing the quality of emergent care for children.

The results of the work in preparation for the consensus conference breakout session and the discussions during the session unmistakably iterated collaboration between general EDs and academic pediatric centers on research, dissemination, and implementation of evidence into clinical practice as a solution to improving the quality of pediatric care across the continuum.

The authors acknowledge the Society for Academic Emergency Medicine for making this project possible. The authors also acknowledge the following individuals: Melissa McMillan for helping coordinate the conference calls, her leadership, and her help organizing the consensus conference/breakout sessions; Ryan Hartman, MD, for helping in scribing and organizing the materials from the breakout session; and Marianne Gausche-Hill, MD, and Alfred Sacchetti, MD, for providing feedback during the initial and midway phases of the project.

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Supporting Information

The following supporting information is available in the online version of this paper available at http://onlinelibrary.wiley.com/doi/10.1111/acem.13642/full

Data Supplement S1. Additional resources.