


NAEMSP RESOURCE DOCUMENT

RESOURCE DOCUMENT: COORDINATION OF PEDIATRIC EMERGENCY CARE IN EMS SYSTEMS

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ABSTRACT

Background: Citing numerous pediatric-specific deficiencies within Emergency Medical Services (EMS) systems, the Institute of Medicine (IOM) recommended that EMS systems appoint a pediatric emergency care coordinator (PECC) to provide oversight of EMS activities related to care of children, to promote the integration of pediatric elements into day-to-day services as well as local and/or regional disaster planning, and to promote pediatric education across all levels of EMS providers. **Methods:** A systematic review of the literature was undertaken to describe the evidence for pediatric coordination across the emergency care continuum. The search strategy was developed by the investigators in consultation with a medical librarian and conducted in OVID, Medline, PubMed, Embase, Web of Science, and CINAHL databases from January 1, 1983 to January 1, 2016. All research articles that measured a patient-related or system-related outcome associated with pediatric coordination in the setting of emergency care, trauma, or disaster were included. Opinion articles, commentaries, and letters to the editors were excluded. Three investigators independently screened citations in a hierarchical manner and abstracted data. **Results:** Of 149 identified titles, nine were included in the systematic review. The nine articles included one interventional study, five surveys, and three consensus documents. All articles favored the presence of pediatric coordination. The interventional study demonstrated improved documentation, clinical management, and staff awareness of high priority pediatric areas. **Conclusion:** The current literature supports the identification of pediatric coordination to facilitate the optimal care of children within EMS systems. In order for EMS systems to provide high quality care to children, pediatric components must be integrated into all aspects of care including day-to-day operations, policies, protocols, available equipment and medications, quality improvement efforts, and disaster planning. This systematic review and resource document serves as the basis for the National Association of EMS Physicians position statement entitled "Physician Oversight of Pediatric Care in Emergency Medical Systems." **Key words:** emergency medical services (EMS) systems; pediatrics; EMS for Children; administration; quality improvement

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INTRODUCTION

Providing high-quality emergency medical services (EMS) to children requires an infrastructure designed to support the care of pediatric patients. Unfortunately, the 2006 Institute of Medicine (IOM) report on the Future of Emergency Care in the United States Health System described multiple challenges facing EMS systems when it comes to meeting the needs of children.¹ Gaps exist in both the clinical and administrative arenas. EMS providers face challenges related to infrequent encounters with children, particularly the critically ill, and maintenance of pediatric skills. Furthermore, there is a paucity of research on best practices, clinical outcomes, and patient safety for the prehospital care of children.

In response to these gaps, the IOM recommended that credentialing and certification organizations define pediatric emergency care competencies and that EMS providers be required to receive initial and continuing education to achieve and maintain those skills. In addition, the IOM recommended that EMS systems appoint a pediatric emergency care coordinator (PECC) to provide oversight of EMS activities related to care of children, to promote the integration of pediatric elements into day-to-day services as well as local and/or regional disaster planning, and to promote pediatric education across all levels of EMS providers.

Beginning in 2006, the federal EMS for Children program developed a set of performance measures to help states evaluate pediatric emergency care. These performance measures allow the EMS for Children program to track ongoing success in integrating the needs of children into our overall emergency care systems. Funding through the EMS for Children program's state partnership grants supports the assessment of local standards for online and offline pediatric medical direction and the integration of pediatric needs into the state EMS system through EMS for Children advisory committees and regulations.² The performance measures are regularly updated, and a new set of standards is scheduled to be released in 2016 for implementation in the 2017 grant cycle. Included in the new proposed EMS for Children performance measures is "EMS Pediatric Emergency Care Coordination: The percentage of EMS agencies in the state/territory that have a designated individual who coordinates pediatric emergency care."³

State EMS for Children advisory committees oversee pediatric-specific goals and activities within state and/or regional EMS systems. Similarly, local pediatric advisory councils offer a means for local EMS agencies and stakeholders to provide input on the development of pediatric policies and protocols. Additional funding from the National Healthcare Preparedness Program (HPP) is available to states, territories, and municipali-

ties to develop and strengthen Healthcare Coalitions,⁴ and to enhance planning and improve infrastructure for pediatric patients.⁵

Pediatric Coordination Within EMS Systems

The 2011 National EMS Assessment by the Federal Interagency Committee on Emergency Medical Services demonstrated that of the 38 responding states, 15 (39%) reported a Pediatric Medical Director.⁶ There is minimal information on the roles or responsibilities of these Pediatric Medical Directors or whether they are compensated for their services.

While children account for up to 10% of EMS transports, in 1995 Snyder *et al.* documented significant deficiencies in state EMS systems, with 77% lacking prehospital triage protocols for specialty populations such as pediatrics.⁷ Data from the 2014 EMS for Children Performance Measures gives a more recent national snapshot of pediatric services within EMS systems. Based on responses from over 6,000 EMS agencies, greater than 90% of Basic Life Support (BLS) and Advanced Life Support (ALS) agencies have access to online pediatric medical direction.⁸ Written pediatric protocols were immediately available to 63% of BLS agencies and 90% of ALS agencies.^{8,9} Based on the 2014 Equipment for Ground Ambulances recommendations, BLS and ALS agencies carried on average 91% and 96% of the nationally recommended pediatric equipment, respectively.^{8,10} The most common equipment deficiencies were the smaller sized respiratory supplies (e.g., neonatal mask for bag-mask ventilation, child size nasal cannula for delivery of oxygen) and pediatric Magill forceps for removal of foreign bodies. Across all areas there were only marginal improvements over the 2011 assessment. Based on 2014 data from EMS for Children state partnership grantees, over 82% of states and territories require pediatric education for license and certification renewal of prehospital providers,¹¹ and 88% have formal EMS for Children Advisory Committees.¹² This is particularly important given that prehospital providers infrequently perform critical procedures on pediatric patients and these are less likely to be successful in the younger age groups.¹³ Day-to-day readiness is important given that children arriving to the emergency department by ambulance are more likely to have higher-acuity illnesses than those arriving by other means.¹⁴ These findings demonstrate that EMS systems are actively engaged in integrating the needs of children into the larger EMS system, yet gaps continue to exist.

Within individual EMS systems and with the assistance of regional or statewide pediatric advisory committees, PECCs can identify and address gaps in the

care of children. The purpose of this publication is to serve as a resource document and provide a systematic review of how the literature has defined the role of an individual and, when warranted, a group to coordinate pediatric care within EMS systems. In addition, it provides information to assist EMS agencies with the establishment of local and/or regional PECCs and pediatric advisory committees.

METHODS

Data Sources and Search Strategy

We conducted a systematic review of the literature to identify descriptions of and scientific evidence for pediatric coordination across the emergency care continuum. We searched the OVID, Medline, PubMed, Embase, Web of Science, and CINAHL databases from January 1, 1983 to January 1, 2016, for all relevant articles. To find all relevant citations related to pediatric coordination, we used a complex set of search strategies that combined medical subject headings and text words for terms related to pediatric coordination in the emergency care setting (Supplement 1). The search strategy was developed by the investigators in consultation with a medical librarian.

Data Selection

We included all research articles that measured a patient-related or system-related outcome associated with pediatric coordination in the setting of an emergency, trauma, or disaster. We excluded opinion articles, commentaries, and letters to the editors. We

included consensus statements. Two investigators (KR and TG) reviewed all citation titles independently in a hierarchical manner. Titles classified as “include” or “indeterminate” by at least one of the investigators were included in the next iteration of review by abstract. Three investigators (MGH, KR, and TG) reviewed all abstracts to identify full articles for review. Disagreements at the full-article stage were resolved by consensus between the three authors (MGH, KR, and TG).

Data Extraction

Three investigators independently abstracted the following information from each article using a data-abstraction tool: the study design, population/demographics, control and intervention, outcome data, setting, type of coordination, and specific recommendations. Any abstraction differences were resolved through consensus among these three authors. Data analysis was performed using STATA version 14 statistical software (StataCorp LP, College Station, TX).

RESULTS

The search strategy identified 149 citations (Figure 1). Of these, 75 were selected for abstract review, of which 20 underwent full-text review. Nine articles met inclusion criteria and were included in our review (Table 1). The kappa measuring inter-rater agreement for title, abstract, and full-text articles was 0.722, 0.554, and 1.0, respectively. Of the included citations, three were consensus documents, five were surveys, and one was an

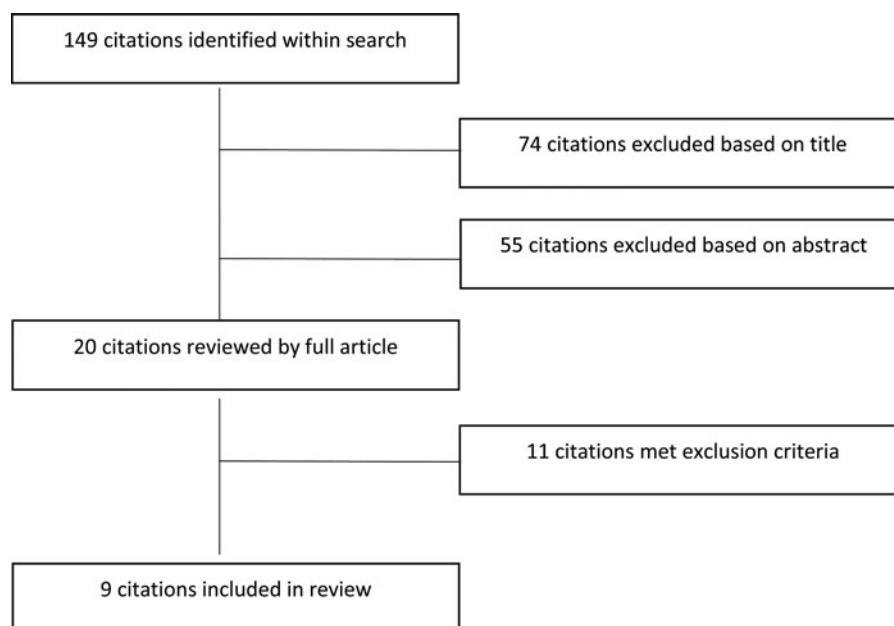


FIGURE 1. Flowchart of the review process.

TABLE 1. Summary of the 9 included citations

Citation	Method	N	Population	Setting	Type of Coordination	Recommendations and/or Outcomes
Sadovich et al. ¹⁵ (2015)	Survey (100% response rate)	45	EDs	Tribal/Indian Health Services	Physician PECC, Nurse PECC	Overall WPRS 60.9, 22% had physician PECC, 42% had nurse PECC. Presence of PECC associated with higher readiness scores across all domains: administration and coordination (13.1 vs. 0), Staff competencies and training (5.5 vs. 4.2), Pediatric quality improvement processes (2.1 vs. 1.8), Pediatric patient safety (10.2 vs. 9.2), policies and procedures (9.8 vs. 8.5), Equipment, Supplies and Medications (30.4 vs. 28.3) but this was only statistically significant for Equipment/Supplies/Medications score
Remick et al. ¹⁶ (2016)	Survey (90% response rate)	335	EDs	California	Physician PECC, Nurse PECC	43% at least one type of coordinator, 33% both types of coordinator; wide range of responsibilities; associated with higher WPRS (85 vs. 58)
Gausche-Hill et al. ¹⁷ (2015)	Survey (83% response rate)	5017	EDs	United States	Physician PECC, Nurse PECC	48% physician PECC, 59% nurse PECC, 42% both PECCs; PECC associated with increased WPRS (82.2 vs. 66.5) across all patient volumes, scores for both PECCs higher than for physician or nurse PECC alone (82.2 vs. 75.3 vs. 69.7); associated with increased likelihood of pediatric quality improvement process (ARR 4.11), pediatric policies and procedures (ARR 2.33), pediatric equipment supplies, and medications (ARR 1.44), and pediatric patient safety measures (ARR 1.30)
Clancy and Kacica ¹⁸ (2012)	Survey (80% response rate)	145	Hospitals	New York	Pediatric Coordinator (physician and/or nurse)	60% physician coordinator, 49% nurse coordinator; presence of physician vs nurse coordinator respectively associated with increased likelihood of having emergency management plan that includes pediatrics (OR 4.02 vs. 3.06), tracking plan for unaccompanied children (OR 6.50 vs. 5.36), plan to house pediatric patients in-place (OR 15.13 vs. 11.50), pediatric equipment (OR 7.22 vs. 6.14), and staff to meet pediatric patient medical needs (OR 28.56 vs. 33.30)
Barfield et al. ²⁰ (2011)	Literature review, Expert opinion	53 experts	Experts in public health, disaster, and medical response	Oak Ridge Institute for Science and Education	Pediatric experts as advisory council	Need for pediatric experts to ensure children are included in mass critical care preparations
AAP, ACEP, ENA ²² (2009)	Consensus statement	Expert panel	AAP, ACEP, ENA	—	Physician PECC; Nurse PECC	Recommend PECC
Gausche-Hill et al. ¹⁹ (2007)	Survey (29% response rate)	5144	EDs	United States	Physician PECC, Nurse PECC	18% doc PECC, 12% nurse PECC, 10% both PECC; 52% had pediatric QI/PI plan (not compared by coordinator role); median 11 of 13 pediatric care policies (not compared by coordinator role); presence of physician and nurse PECC associated with higher WPRS across all types of facilities: Standby (81 vs. 57), Basic (80 vs. 68), General (84 vs. 72), Comprehensive (87 vs. 79).

(Continued on the next page)

TABLE 1. (Continued).

Citation	Method	N	Population	Setting	Type of Coordination	Recommendations and/or Outcomes
Oakley et al. ²¹ (2004)	Interventional study with survey and retrospective review	117 charts	ED, Families, Staff	Melbourne, Australia	Joint Liaison Committee: Emergency Directors, Hospital Executives, Director of Pediatric Services, Director of Medicine Services, physician and nurse PECCs	Development of a designated pediatric area within the ED, identification of physician and nurse PECCs to provide education and training, development of pediatric specific protocols for top 15 most common diagnoses and 10 high-risk diagnoses, Outcomes included decreased pediatric inter-facility transfers (4.9 vs. 4.1 per month) and inpatient pediatric bed usage (6% reduction), improved triage documentation (50% vs. 85%), decrease in inappropriate asthma management (12 vs. 5), increased pain management (50% vs. 100%), and increased staff awareness of high priority issues in pediatrics (12% vs. 29%)
AAP and ACEP (2001) ²³	Consensus statement	Expert panel	AAP, ACEP	—	Physician PECC, Nurse PECC	Recommend PECC

ED: Emergency Department; PECC: Pediatric emergency care coordinator; WPRS: Weighted pediatric readiness score; AAP: American Academy of Pediatrics; ACEP: American College of Emergency Physicians; ENA: Emergency Nurses Association; QI/PI: Quality Improvement/Process Improvement.

interventional study. The results from data abstraction can be found in Table 1.

Population Demographics and Settings

All five of the qualitative surveys were performed in the United States including one that was limited to Indian Health Services and Tribal areas.¹⁵⁻¹⁹ Four of the five surveyed hospital emergency departments (across the entire United States or in California), and one surveyed hospitals in New York. Two articles (one consensus document and one survey) focused on disaster preparedness^{18,20}; the remainder focused on pediatric emergency care in the ED setting. Two of the articles evaluated the impact of pediatric experts serving in an advisory capacity^{20,21}; the remainder evaluated the role of a pediatric care coordinator. There was no emphasis or delineation of rural, suburban, or urban settings. The definition of pediatric was not consistently defined across studies. The interventional study was carried out in Australia and included pediatric patients seen in the emergency department.²¹

Intervention/Coordination Role and Responsibilities

The exact roles and responsibilities of the pediatric coordinator were not clearly outlined in every article. However, the majority identified the pediatric coordinator as someone who serves in a broad capacity focused on pediatric care including liaison work, clinical protocol development, quality improvement efforts, patient safety, and education/training. Across

all studies, the pediatric coordinator position was filled by a physician and/or nurse with expertise in pediatric emergency care. Of the articles that evaluated the role of a pediatric advisory council, only one identified the individuals who served in that capacity.²² Specific members included nurses, physicians, and administrative leaders across the continuum of care. The Pediatric Emergency Mass Critical Care Task Force recommended that “pediatric experts must be involved in all aspects of emergency and disaster planning.”¹⁹ The Australian interventional study created a partnership between a tertiary pediatric hospital and a mixed population hospital, utilizing a joint liaison committee comprised of a pediatric emergency physician and pediatric clinical nurse facilitator, in addition to emergency service directors and hospital executives.²²

Outcomes and Recommendations

Specific outcomes and recommendations associated with pediatric coordination are summarized in Table 1. The three consensus documents list recommendations, which include the identification of a PECC in the emergency department and the inclusion of pediatric experts in disaster planning.^{20,22,23}

The Australian interventional study evaluated the impact of a pediatric advisory council to develop a pediatric-specific treatment area, identify physician and nurse PECCs to facilitate education and training among staff, and the adoption of pediatric clinical practice guidelines. Implementation of these three elements resulted in an increase in overall pediatric patient vol-

ume, a decrease in inter-facility transfers, increase in pediatric triage including vital sign assessment and pain management, and a decrease in variations in clinical practice. In addition, the interventions resulted in increased parent satisfaction, staff confidence, and awareness of pediatric needs.²¹

The five survey studies each reported the prevalence of a PECC among surveyed entities and measured the association of PECC presence with various other outcomes. Four of the 5 survey studies utilized the weighted pediatric readiness score (WPRS). The WPRS was developed by assigning a weighted score based upon a 55-item survey. A panel of experts developed the initial weighting criteria for the score. The survey was then piloted among a select group of emergency departments in California. Based on the expert panel and the pilot assessment results, 24 of the survey items were weighted to generate an overall score, which was normalized to a 100-point scale. Weighting for each section of the assessment included coordination of care (19 points), physician and nurse staffing (10 points), quality improvement (7 points), patient safety (14 points), policies and procedures (17 points), and equipment and supplies (33 points).¹⁷

The 2013 national assessment of emergency departments, in which pediatric patients accounted for up to 25% of all emergency department visits, demonstrated the impact of PECCs on readiness to care for children.¹⁷ This assessment demonstrated that 59% of emergency departments had a nurse PECC and 48% had a physician PECC; 42% had both types of PECC. This was a significant improvement from the prior national survey in 2003, which demonstrated nurse PECC presence of 12% and physician PECC presence of 18%.²¹ In multiple surveys, emergency departments with a PECC had a significantly higher level of readiness to care for children, as measured by the WPRS.^{15-17,19} In the 2013 survey the median adjusted WPRS was 82 for emergency departments with a PECC vs. 67 for those without.¹⁷ This association with higher WPRS persisted across all pediatric ED volume categories. The presence of a PECC was associated with a higher likelihood of having all of the other recommended components of the 2009 Guidelines for Care of Children in the Emergency Department¹⁶ in place. Deficiencies included presence of a quality improvement program that includes children (55% lacking) and a disaster plan that addresses children (53% lacking).¹⁷

The report on California emergency departments outlined the roles and responsibilities of a PECC.¹⁶ These roles and responsibilities included facilitating continuing education, development of pediatric policies and procedures, oversight of quality improvement and patient safety efforts, liaising with regional facilities and organizations as well as hospital committees, and ensuring pediatric needs are addressed in disaster planning.

The highest prevalence of physician PECCs was noted in the survey of New York hospitals related to emergency preparedness planning, where 60% of hospitals had a physician coordinator. The presence of a PECC (physician or nurse) was associated with having the following: emergency management plans that include pediatric-specific plans, a tracking plan for unaccompanied children, the ability to house pediatric patients in place, pediatric equipment, and staff to meet pediatric medical needs.¹⁸

DISCUSSION

The coordination of pediatric care and the readiness to treat children within our nation's emergency departments is enhanced with the presence of PECCs. The presence of a physician or nurse PECC has been associated with higher pediatric readiness scores and increased compliance with national guidelines for the care of children in emergency departments. This includes having appropriate equipment and medications, staff who are certified/trained appropriately, staff competency evaluations, pediatric patient safety measures, and key policies or procedures in place.

It is expected that the same benefits will be realized in prehospital EMS systems that utilize a PECC. While pediatric patients treated in U.S. emergency departments account for nearly 25% of all patient visits, the pediatric proportion of patients treated in EMS systems is much less, an estimated 7-13%.^{13,14} The pediatric readiness assessment demonstrated that facilities with lower annual pediatric patient volumes were less likely to be pediatric ready than facilities with higher annual pediatric patient volumes in the absence of a PECC.¹⁷ Having a designated individual who coordinates pediatric emergency care may be even more important for EMS systems, where pediatric care is less of an everyday occurrence. To this end, an advisory committee to the federal EMS for Children program, made up of national pediatric EMS subject matter experts, determined that states and territories be required to report the percentage of EMS agencies that have a designated individual who coordinates pediatric emergency care. The Maternal and Child Health Bureau of the Health Resources and Services Administration has set the following goals for obtaining this performance measure: 30% of agencies by 2020, 60% of agencies by 2023, and 90% of agencies by 2026.³

The role of a PECC within an EMS system is to work collaboratively with the EMS system administrator and physician medical director to improve the care of children. This would be accomplished by:

- identifying gaps and ensuring that resources to care for children are available
- maintaining a relationship with the state EMS for Children infrastructure

- establishing and maintaining offline and online pediatric EMS protocols
- establishing quality improvement plans with pediatric-specific indicators.

Additional activities may include but not be limited to the following:

- liaising with hospitals to improve pediatric readiness of emergency departments
- coordinating with dispatch to provide evidence-based, pre-arrival instructions for children and/or caretakers
- reviewing on a regular basis the medications and devices available for prehospital care of children
- assisting in education and training of EMS providers in the care of children and principles of family-centered care
- working with state and local authorities and regional coalitions to develop strategies for addressing pediatric needs in the event of a disaster.

It is expected that the PECC have a background in pediatrics, emergency medicine, pediatric emergency medicine and/or EMS with a clear understanding of clinical practice as well as the administrative aspects of EMS systems and EMS provider scope of practice. Fellowship-trained emergency physicians in pediatric emergency care or EMS are well-qualified for the physician PECC position; nurse practitioners, paramedics, mobile intensive care nurses, and/or nurse educators with pediatric expertise or training may also serve well as a PECC.

Not all systems will have the ability to fund a full-time PECC but may assign this role and the accompanying responsibilities to an existing staff member. Other systems may expand the role of the PECC, such as the Pediatric EMS Medical Director, who could assist the EMS Medical Director in overall medical oversight of the EMS system's pediatric care. Depending on the size and needs of the system, a part-time, voluntary, or shared position may be sufficient. Additionally, EMS systems may consider funding the position cooperatively as a shared resource with other healthcare entities.

Ideally, complementing the PECC is a Pediatric Advisory Committee composed of key stakeholders in the care of children. The Pediatric Advisory Committee is ideally composed of a diverse group of local pediatric stakeholders including EMS providers, physicians and nurse leaders in emergency medicine, pediatric emergency care, trauma, and pediatric critical care from all geographic areas in the region. In addition, *ad hoc* representatives with experience in system-based policies, protocol development, research, and quality improvement efforts may serve on the committee.

This committee would be advisory to the authoritative body for the EMS System such as a governing board or EMS Commission. The activities and responsibilities of the Pediatric Advisory Committee may include but are not limited to:

- reviewing EMS system activities and policies for the prehospital care of children
- developing categorization systems to identify local or regional emergency departments that are able to stabilize and manage pediatric emergencies
- writing and reviewing pediatric-specific protocols for the prehospital care of children
- identifying and instituting pediatric-specific quality improvement measures,
- developing a local/regional pediatric disaster surge plan
- organizing and assisting with pediatric disaster drills.

Further evidence for systematic pediatric emergency care coordination exists. Pediatric verification programs for emergency departments have been associated with greater readiness to care for children and may be associated with decreased mortality among injured children.^{16,24} While the specific impact of pediatric emergency care coordination at the prehospital level has not been assessed, a similar trend is expected across the larger healthcare continuum.

Resources Available to PECCs and Pediatric Advisory Committees

Multiple resources are available to PECCs and pediatric advisory committees, including online and offline pediatric medical direction, educational and disaster resources, as well as system-based policies and procedures (Table 2).

CONCLUSION

EMS is a multi-faceted, multidisciplinary field that serves diverse populations. Pediatric patients have unique needs that every EMS program must ensure are appropriately met. The prehospital care of children requires EMS systems to have and maintain policies and procedures that cover all aspects of pediatric emergency care. This coordination may benefit from the presence of a designated individual to coordinate the care of children. An EMS PECC facilitates the integration of pediatric needs into all aspects of EMS. Additionally, the establishment of a pediatric advisory committee will ensure system-based quality improvement efforts to evaluate and address ongoing integration of pediatric-specific needs within EMS systems. Multiple resources exist to assist EMS administrators in developing such roles. Future research into

TABLE 2. Pediatric resources

Online and Offline Pediatric Medical Direction Resources:
 Children with Special Healthcare Needs: A Template for Prehospital Protocol Development²⁵
 Model EMS Clinical Guidelines²⁶
 EMS for Children Medical Direction Toolbox^{27,28}
 Consent of EMS for children and adolescents²⁹


Educational Resources:
 Teaching Resource for Instructors in Prehospital Pediatrics – BLS³⁰ and ALS³¹
 Pediatric Education of Prehospital Professionals³²
 Emergency Pediatric Care³³
 EMS for Children Prehospital Education Toolbox³⁴
 Special Children's Outreach and Prehospital Education (SCOPE)³⁵
 EMS for Children Patient- and Family-Centered Care Toolbox³⁶
 EMS for the Pediatric Emergency Physician³⁷

Disaster Resources:
 EMS for Children Pediatric Disaster Preparedness Toolbox³⁸
 Pediatric Disaster Preparedness Resource³⁹
 Pediatric Disaster Triage: JumpSTART⁴⁰
 California EMS for Children Pediatric Disaster Preparedness Guidelines for Local EMS Agencies⁴¹
 Pediatric Preparedness Resource Kit⁴²

System-Based Policies and Procedures:
 Joint position statement on Equipment for Ambulances⁴³
 Models for Facility Categorization^{44,45}
 EMS for Children Facility Categorization Toolbox⁴⁶
 EMS for Children Inter-facility Transfer Toolbox⁴⁷
 Guidelines for Air and Ground Transport of Neonatal and Pediatric Patients⁴⁸

best practices for EMS systems is critical to evaluate the magnitude of the impact of a PECC within EMS systems.

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