Review Article

From the street to the ICU: a review of pediatric emergency medical services and critical care transport

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Abstract: Emergency medical services and critical care transport teams are relatively new parts of the American healthcare delivery system. Although most healthcare providers regularly interact with these groups and rely upon their almost ubiquitous availability, few know how these services developed or what sort of infrastructure currently exists to maintain them. This article provides a focused overview of the history and present practices of both emergency medical services and critical care transport teams, with a concentrated look at the implementation of these services in the pediatric population. Within this context, we also consider current challenges and future opportunities for both groups and conclude with ways to become involved in the improvement of out-of-hospital pediatric critical care.

Keywords: Critical care; emergency medical services (EMS); modern medicine; pediatrics

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Introduction

Although critical care of children is commonly thought to occur only within the walls of a pediatric intensive care unit, lifesaving interventions often begin or continue outside the hospital, enabling severely ill and injured children to survive to their definitive treatment facility. Whether it is on first contact during a 9-1-1 call, at first response on scene, or on transfer between facilities, the public expects that safe, effective, and evidence-based clinical management will be executed perfectly every time by emergency medical services (EMS) and critical care transport (CCT) teams. EMS and CCT teams have evolved drastically over the years to meet these expectations. In this article, we review the history, present practice, and future opportunities for each of these groups. We also highlight key differences between them.

EMS

History

One of the earliest accounts of a system to treat prehospital injuries and illnesses came from Baron Dominique Jean Larrey during the French Revolution in 1794 (1). In the US, General Jonathan Letterman successfully adapted Larrey's designs for the transport of injured soldiers during the Civil War, and in 1865, the Commercial Hospital of Cincinnati developed the first civilian-run, hospital-based ambulance service (2). A few years later, New York City developed the first municipally-based EMS system (3). This landscape of disparate hospital- and municipally-based EMS was relatively unregulated until the 1960's, when the use of cardiopulmonary resuscitation (CPR), defibrillators, and advanced cardiac life support (ACLS) was found to improve outcomes. In response, the federal government articulated standards for EMS at the state and regional level (4). In 1965, the President's Committee for Traffic Safety published a seminal report, which contained 11 recommendations for prehospital care that cemented the foundation for the EMS system we know today.

Within this backdrop of growth for EMS, attention began shifting to the unique needs of pediatric emergency care. A series of articles in the 1980's brought realization that pediatric ambulance runs were infrequent and that both training and pediatric-specific equipment were lacking for prehospital personnel (5). Furthermore, it was found that injured children's outcomes were generally worse than those of equally injured adults (6). This inspired action, and the American Academy of Pediatrics (AAP) formed the Section on Pediatric Emergency Medicine; the federal government established the emergency medical services-children (EMS-C) grant program to assist states in addressing pediatric needs within their emergency systems; the American Heart Association (AHA) and the AAP developed pediatric advanced life support (PALS); and finally in 1992, the American Board of Medical Specialties administered the first certifying exam in pediatric emergency medicine (7). Since that time, the relatively young field of pediatric-oriented emergency care has continued to grow.

Present practice

There are approximately 137 million emergency department (ED) visits annually in the United States and around 21 million of these patients arrive by ambulance via EMS (8). Of those, 1.2 million EMS arrivals are children under 15 years old.

Despite, or perhaps due to, the need for complete coverage of the country, federal regulation of EMS is fragmented (9). While EMS is housed within the National Highway Traffic Safety Administration (NHTSA) of the Department of Transportation, it receives funds from Health and Human Services via the Health Resources and Services Administration and the Centers for Disease Control, and from the Office of Domestic Preparedness. As with physicians where each state has its own medical board that determines physician licensure, each state has an EMS board that determines scope of practice, and requirements for new and continued licensure of EMS practitioners. In 2007, the NHTSA published the National EMS Scope of Practice Model to provide general recommendations around scope of practice and licensure, but these are not mandatory guidelines (10).

In the most current version of the Scope of Practice Model there are four designations for EMS professionals: Emergency Medical Responder (EMR), Emergency Medical Technician (EMT), Advanced EMT (AEMT), and Paramedic. As stated within the document, their differing roles are:

(I) EMR: "*The primary focus of the Emergency Medical Responder is to initiate immediate lifesaving care to critical patients who access the emergency medical system*."

(II) EMT: "… *to provide basic emergency medical care and transportation for critical and emergent patients who access the emergency medical system*."

(III) AEMT: "… *to provide basic and limited advanced emergency medical care and transportation for critical and emergent patients who access the emergency medical system*."

(IV) Paramedic: "… *to provide advanced emergency medical care for critical and emergent patients who access the emergency medical system*."

In practice, an EMR may initiate resuscitation on scene by applying a non-rebreather mask, after which an EMT might begin bag valve mask ventilation, followed by a Paramedic who might perform a drug-assisted endotracheal intubation. Typically, the scope of an EMR includes the following skills: airway positioning and bag valve mask ventilation, hemorrhage control, automated electronic defibrillator (AED) defibrillation, CPR and newborn deliveries. EMTs typically do all an EMR does with the addition of the following: providing medications such as oxygen, sublingual nitro, inhaled medications, oral glucose, EpiPen administration; taking vital signs; bag valve mask ventilation; extremity splinting; and spinal immobilization. AEMTs additionally may perform electrocardiograms (EKGs), endotracheal intubation, nasogastric tube placement, determination of death, defibrillation and pacing, needle thoracotomy, aspiration of newborn meconium, intravenous line placement, and drug administration. Paramedics, finally, add the following to their skill sets: termination of CPR in progress, needle or surgical cricothyrotomy, nasotracheal and drug-assisted intubation, and 12 lead EKG interpretation.

The important point to note is that EMS professionals have no independent authority. It is helpful to think of them as extensions of licensed physicians. Their entire practices are based upon identifying a patient's chief complaint and selecting the appropriate guideline or protocol to follow step-by-step. Medical direction can be either "online" or "offline". Guidelines and protocols are examples of offline medical direction, whereas, calling and speaking to a physician in real-time at the patient's bedside is online medical direction. It is important to stress that there are limits to the directions or orders a physician may give an EMS professional. EMS professionals are never allowed to exceed their scope of practice determined by their states. A paramedic, for example, may not have a protocol for endotracheal tube intubation but may be directed by a physician to perform this skill as it is included in most states' scope of practice. However, a paramedic would never be allowed to perform a perimortem caesarian section in the field, even if he or she could be walked through the entire procedure by a licensed physician, as it is not included in any states' scope of practice. That paramedic may lose his or her license and even face civil litigation.

There are tremendous differences in education required from one category of EMS professional to the next. Typically, EMRs require around 40 hours of training, EMTs require around 100 hours of training, AEMTs require around 1,000 hours of training, and paramedics require up to 3,000 hours of training. The number and type of available EMS professionals varies greatly by community, where a small rural EMS agency may have fewer than five volunteer-based EMR, and a large urban fire department may employ over 300 career-based paramedics. According to the National Registry of EMTs (NREMT), the largest category of certified EMS professionals is EMT (11). This is likely because EMT certification may be obtained with only 100 hours of training and generally still affords the skills to provide good CPR to patients in arrest. Detailed statistics are difficult to obtain given the ambiguously broad definition of EMS systems and reliance upon self-report, but one study of large metropolitan areas found that 89% of first responders are based out of fire departments (12). A national survey administered by the US Fire Administration found that 60% of fire departments report providing at least BLS services to their communities (13). Outside of fire departments, a plethora of EMS providers continue to exist, including private, public, volunteer, and hospital-based systems. Air ambulance systems began operating in the 1970's and are also managed via a similar mix of systems as they have grown in number.

Future opportunities

In 2006, the IOM published their report "Emergency Medical Services: At the Crossroads" (9), and in the subsequent year, "Emergency Care for Children: Growing Pains" (7). In these reports, the IOM identified several priorities for the improvement of both general and pediatric EMS. In broad categories, these priorities were:

(I) Designation of a federal lead agency;
(II) Evaluation of system finance and reimbursement policies;
(III) National standardization and state reciprocity of training and credentialing;
(IV) Creation of EMS subspecialty certification;
(V) Improvement of coordination between dispatch, EMS, air medical providers, hospitals, and trauma centers;
(VI) Development of integrated and interoperable communications and data systems;
(VII) Assumption of regulatory oversight by states for air medical services;
(VIII) Establishment of a panel to develop evidence-based indications of emergency are system performance;
(IX) Increase in funding and resources for disaster preparedness;
(X) Increase in funding and opportunities for emergency and trauma care research.

These priorities attempt to tackle the problems presented by a large, complex, disparately-managed, but necessary, system of life-saving services. Since 2006, two updates in 2009 and 2010 from the IOM have tracked the government's response to their recommendations, which demonstrate limited progress in select states (14,15).

In 2012, EMS-C prioritized nine performance measures (16):

(I) Submission of NEMSIS Compliant Version 3.x-Data;
(II) Pediatric Emergency Care Coordinator;
(III) Use of pediatric-specific equipment;
(IV) Hospital recognition for pediatric medical emergencies;
(V) Hospital recognition for pediatric trauma;
(VI) Interfacility transfer guidelines;
(VII) Interfacility transfer agreements;
(VIII) Permanence of EMS-C;
(IX) Integration of EMS-C priorities into statutes or regulations.

EMS, and more specifically, EMS-C is a young field that has grown spectacularly in recent history. However, there continue to be significant needs and opportunities to improve. With such great needs come great opportunities to advance the care of children. As critical care specialists, you the reader may be in the best position to take a leadership role in your local emergency medical services. By becoming a "Institute of Medicine-endorsed" Pediatric Emergency Care Coordinator for your hospital or local EMS agency, you may have the ability to contribute significantly to pediatric-centered teaching, research, and legislation. In the authors' experiences, one's time contribution to this effort may be high-impact for as little as a 2-hour-a-month investment.

CCT

CCT for children evolved as a result of the regionalization of neonatal and pediatric specialty care. Quaternary and tertiary care centers depend on teams to provided safe and effective care for patients *en route* from community hospitals to hospitals where they ultimately receive definitive care. In the continuum of care for critically ill or injured children, the chain often starts with EMS beginning care at the scene and continuing until transferring care at the local community hospital. After stabilization in the local hospital's ED, interfacility transport teams continue (and may escalate) the patient's care on the way to the definitive care center.

History

Pediatric specialty transport teams grew in the 1960's and 1970's primarily to service the field of neonatology and its need to transfer safely critically ill newborns from community hospitals to regional neonatal intensive care units (NICUs) (17). These subspecialty teams quickly demonstrated that they decreased morbidity and mortality in comparison to EMS-based systems (18). For many quaternary and tertiary NICUs without a corresponding delivery service, neonatal transport teams are the primary mechanism by which they receive patients. Subspecialty transport teams for older pediatric patients began to develop about a decade later, also demonstrating improved outcomes for their patients versus EMS transport (19,20). Over the years, neonatal and pediatric subspecialty transport teams have evolved to excel at improving patients' conditions during the interval from the bedside at the referring facility to patient hand-off at the accepting hospital—all while minimizing the potential adverse effects of the mobile environment. This practice is in contrast to the common prehospital EMS approach of "scoop and run" from the scene of an incident to the ED when only minimal interventions needed to resuscitate and stabilize the patient are initiated in order to expedite transport.

Present practice

Approximately 250,000 patients a year less than 21 years of age are transferred from one facility to another for admission. Most of these are transferred via interfacility transport teams (21,22). Although there is a tremendous amount of variability amongst how neonatal—pediatric transport teams are configured, there are commonalities amongst most. Key components include the following: real-time medical direction by "medical control" physicians knowledgeable of critical care and the peculiarities of transport medicine; vehicles adequately equipped to allow personnel to deliver critical interventions and therapeutics without relying on supplies from the referring facilities; communication/dispatch capabilities; standard operating procedures and clinical guidelines or protocols; quality review and improvement programs; medical and nursing clinical directors; administrative support; and the business and financial support for sustainability (17).

Interfacility transport teams may be dedicated teams with responsibilities only for transporting pediatric and/or neonatal patients, or they may be unit-based teams. Unit-based teams tend to be lower volume transport programs that depend on staff with inpatient assignments to hand-off care to colleagues before leaving to conduct an interfacility transport. Large interfacility transport teams may have different service lines capable of transporting patients of different acuities. All neonatal-pediatric CCT teams support mobile intensive care units (MICU), but some may also have ALS and BLS units for lesser acuity patients.

The most common team composition for neonatal-pediatric MICU teams is a registered nurse and a respiratory therapist. Most recognize the registered nurse as team leader. However, other disciplines are commonly used by various organizations including physicians, nurse practitioners, physician assistants, paramedics, and EMTs. Only a small minority of programs regularly include a physician as part of their MICU teams (23,24). With easy access to an appropriate medical control physician via phone or radio, likely it is less important what combination of disciplines comprise the MICU team and more important what their combined years of experience with subspecialty transport is. Many programs require a minimum number of years' experience in a critical care environment prior to being hired to work on transport. In addition, it is important that orientation to transport include introduction to the environments of transport, a thorough review of safety procedures, and attention to customer service as transport teams are often a family's first interaction with a particular hospital system. These first impressions may make or break a family's hospitalization experience.

Although transport medicine borrows from many specialties, it is much more than the sum of its parts from neonatology, pediatric intensive care, cardiology, emergency medicine, etc. There are important, unique aspects of transport medicine that make it impossible to assume that someone competent in an ICU setting will be equally competent in the environment of transport or in a referral ED. Competencies in the peculiarities of transport such as knowing flight physiology, mitigating the adverse effects of the transport environment (i.e., temperature fluctuation, vibration, & noise), working in the confined environment of a small plane or helicopter, and comfortably assessing a patient with or without the use of accurate monitoring equipment are critical.

The literature supports that improved patient outcomes come with use of specialty neonatal-pediatric transport teams. These teams are specifically developed to bring neonatal-pediatric critical care expertise and to implement early, goal-directed therapy when appropriate to patients even while they are still in the referring facility. In his important prospective, cohort study at the Children's Hospital of Pittsburgh, Orr *et al.* found that pediatric patients transported by nonspecialized teams encountered far more unplanned events during transport including airway-related mishaps, CPR, sustained hypotension, and loss of crucial IV access. Death within 28 days of hospitalization occurred for 23% of patients transported by nonspecialized teams, compared with 9% of those transported by specialized teams (20).

Ideally, a transport team should be capable of arranging transfer of a patient via ambulance, helicopter, or airplane even if they cannot complete the transport themselves. As described in the Emergency Medical Treatment and Active Labor Act (EMTALA), technically the referring physician is responsible for determining the mode of transport and the composition of the transporting team. However, in practice, these decisions are either deferred to the transport teams or made collaboratively with the referring physician.

Transports are not limited to those bringing patients to the quaternary and tertiary medical centers. Best practices support policies and interfacility agreements that facilitate "reverse transports" as well. These are transports back to the local community hospitals when hospitalization is still required but subspecialty intensive care no longer is. This is also an important mechanism for freeing up bed capacity in pediatric and neonatal intensive care units.

Future directions

Until 2012, no set of national consensus quality metrics existed for benchmarking transport teams. The AAP Section on Transport Medicine (SOTM) aimed to remedy this by achieving national consensus on appropriate neonatal and pediatric transport quality metrics. Using a modified Delphi technique, attendees of the 2012 AAP SOTM Quality Metrics Summit identified the following 12 metrics as "very important" to transport and urged that transport teams across the country use these metrics to benchmark and guide their quality improvement activities (25).

- (I) Unplanned dislodgement of therapeutic devices;
- (II) Verification of tracheal tube placement (confirmatory techniques);
- (III) Average mobilization time of the transport team;
- (IV) Tracheal tube placement success;
- (V) Rate of transport-related patient injuries;
- (VI) Rate of medication administration errors;
- (VII) Rate of patient medical equipment failure during transport;
- (VIII) Rate of CPR performed during transport;
- (IX) Rate of serious reportable events;
- (X) Unintended neonatal hypothermia upon arrival to destination;
- (XI) Rate of transport-related crew injury;
- (XII) Use of a standardized patient care hand-off.

In the summer of 2013, the Air Medical Physician Association (AMPA) hosted its Quality Metrics Consensus Conference. A multidisciplinary group of participants was selected specifically to include the variability of air/ground medical transport programs across North America. Using a similar methodology to that used by the AAP SOTM, AMPA achieved consensus on a metric set appropriate for all transport programs by including both adult and pediatric performance metrics. Several of the AAP SOTM metrics, by consensus, became part of the AMPA metric set.

Also, in 2013, the AAP SOTM met to update a decade-old consensus document by summarizing the current evidence and expert opinions regarding neonatal-pediatric interfacility transport in the US (26). This document discusses the expectations for the role of a physician medical director; the importance of being accredited by an external agency after a thorough program assessment; the priorities for transport-specific clinical research; how best to support transport teams through training, simulation, and attention to safety; the roles of transport teams in disaster planning; the role of EMTALA in the practice of transport; and finally the importance of transport-specific benchmarks established by those most familiar with neonatal-pediatric transport. It also recognized strong support for the development and maintenance of a national neonatal-pediatric transport-specific database to facilitate tracking quality metrics and strengthen efforts to define practice standards (27).

In 2014, the Ground and Air Medical Quality in Transport (GAMUT) Quality Improvement Collaborative was created. This initiative, referred to as GAMUT for short, uses a web-based database to track monthly, aggregate level CCT performance scores for a comprehensive set of adult, pediatric, and neonatal quality metrics drawing metrics from both the AAP SOTM's and the AMPA's sets (www.gamutqi.org). The GAMUT Quality Improvement Collaborative is comprised of a steering committee and over 300 transport teams, including some programs outside of the US. Benchmark performance feedback reports are available to programs to allow comparison with others. GAMUT recently completed its first collaborative-wide improvement project to increase the use of waveform capnography during transport for neonatal and pediatric patients with advanced airway devices. Performance remained high for use with pediatric patients and improved substantially for the neonatal population. These results are to be reported soon.

GAMUT's reporting of performance feedback to its participating member programs over time has in itself positively impacted patient care. For example, blood glucose measurement in patients with altered mental status, first attempt intubation success, confirmation of tracheal tube placement, and mechanical ventilation utilization have all demonstrated statistically significant collaborative-wide performance improvement despite there being no large coordinated improvement projects. As GAMUT continues to mature, expect collaborative-wide improvement activities, additional performance metrics and the evolution of evidence-based best practices to enhance the field of neonatal-pediatric transport.

Conclusions

When ill and injured children require care at a hospital, and transportation by private car is not appropriate, EMS and CCT teams fulfill that role. EMS practitioners are often the first to respond to critically ill and injured children. While prehospital care of children has improved over time, EMS practitioners may not have the exposure to children that subspecialty CCT teams have. Therefore, they may not have the training or comfort to practice to their entire scope of practice. Each of us has the opportunity to advocate for safe and effective prehospital care of children by getting involved with our local EMS agencies. Neonatal-pediatric subspecialty teams have demonstrated their importance in bringing sophisticated critical care to the patient's bedside and safely continuing care while *en route* to another facility. Whether an injury on the playground requires EMS care, or a premature infant requires transport for surgical procedures, the continuum of care for children is stronger than it has ever been. Continued attention to improving the quality of pediatric EMS and CCT systems using evidence-based performance metrics is key to the future of these organizations and to the health of our children.

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Footnote

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References

1. Pozner CN, Zane R, Nelson SJ, et al. International EMS systems: The United States: past, present, and future. Resuscitation 2004;60:239-44.
2. Boyd DR. The conceptual development of EMS systems in the Unites States, Part II. Emerg Med Serv 1982;11:26, 28-30, 32-3 passim.
3. Haller JS Jr. The beginnings of urban ambulance service in the United States and England. J Emerg Med 1990;8:743-55.
4. National Highway Traffic Safety Administration. Emergency Medical Services Agenda for the Future. Available online: https://www.nhtsa.gov/people/injury/ems/agenda/emsman.html
5. Seidel JS. Emergency medical services and the pediatric patient: are the needs being met? II. Training and equipping emergency medical services providers for pediatric emergencies. Pediatrics 1986;78:808-12.

6. Seidel JS. A needs assessment of advanced life support and emergency medical services in the pediatric patient: state of the art. Circulation 1986;74:IV129-33.
7. Committee on the Future of Emergency Care in the United States. Emergency Care for Children: Growing Pains. Washington, D.C.: Academies Press, 2007.
8. Rui PK, Kang K. National Hospital Ambulatory Medical Care Survey: 2015 Emergency Department Summary Tables. Available online: https://www.cdc.gov/nchs/data/nhamcs/web_tables/2015_ed_web_tables.pdf
9. Committee on the Future of Emergency Care in the United States. Emergency Medical Services: At the Crossroads. Washington, D.C.: National Academies Press, 2006.
10. National Highway Traffic Safety Administration. National EMS Scope of Practice Model. Available online: http://www.ems.gov/pdf/education/EMS-Education-for-the-Future-A-Systems-Approach/National_EMS_Scope_Practice_Model.pdf
11. National Registry of Emergency Medical Technicians. Annual Report Columbus, Ohio 2016. Available online: https://content.nremt.org/static/documents/annual-reports/2016_Annual_Report.pdf
12. Mears G. Survey and Analysis of EMS Scope of Practice and Practice Settings Impacting EMS Services in Rural America: Executive Brief and Recommendations. Chapel Hill, NC: University of North Carolina at Chapel Hill, Department of Emergency Medicine; 2004.
13. U.S. Fire Administration's National Fire Department Registry. National Fire Department Registry Summary. Emmitsburg, MD; 2018.
14. Institute of Medicine. National Emergency Care Enterprise: Advancing Care through Collaboration: Workshop Summary. Washington (DC): National Academies Press (US), 2009.
15. Institute of Medicine. Regionalizing Emergency Care: Workshop Summary. Washington (DC): National Academies Press (US), 2010.
16. Emergency Medical Services for Children. Performance Measures 2012. Available online: https://emscimprovement.center/emsc/performance-measures/
17. American Academy of Pediatrics. Section on Transport Medicine. Guidelines for air and ground transport of neonatal and pediatric patients. 4th edition. Elk Grove Village, Ill.: American Academy of Pediatrics, 2016.
18. Usher RH. The role of the neonatologist. Pediatr Clin North Am 1970;17:199-202.
19. Ajizian SJ, Nakagawa TA. Interfacility transport of the critically ill pediatric patient. Chest 2007;132:1361-7.
20. Orr RA, Felmet KA, Han Y, et al. Pediatric specialized transport teams are associated with improved outcomes. Pediatrics 2009;124:40-8.
21. Agency for Healthcare Research and Quality. HCUPnet, Healthcare Cost and Utilization Project. Rockville, MD. Available online: https://hcupnet.ahrq.gov/
22. Rosenthal JL, Hilton JF, Teufel RJ 2nd, et al. Profiling Interfacility Transfers for Hospitalized Pediatric Patients. Hosp Pediatr 2016;6:345-53.
23. Karlsen KA, Trautman M, Price-Douglas W, et al. National survey of neonatal transport teams in the United States. Pediatrics 2011;128:685-91.
24. Tanem J, Triscari D, Chan M, et al. Workforce Survey of Pediatric Interfacility Transport Systems in the United States. Pediatr Emerg Care 2016;32:364-70.
25. Schwartz HP, Bigham MT, Schoettker PJ, et al. Quality Metrics in Neonatal and Pediatric Critical Care Transport: A National Delphi Project. Pediatr Crit Care Med 2015;16:711-7.
26. Woodward GA, Insoft RM, Pearson-Shaver AL, et al. The state of pediatric interfacility transport: consensus of the second National Pediatric and Neonatal Interfacility Transport Medicine Leadership Conference. Pediatr Emerg Care 2002;18:38-43.
27. Stroud MH, Trautman MS, Meyer K, et al. Pediatric and neonatal interfacility transport: results from a national consensus conference. Pediatrics 2013;132:359-66.

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