EMSC Impact and Outcomes References

The EMS for Children program has a goal to reduce child and youth mortality and morbidity sustained as a result of severe illness or trauma and to be fully integrated along the continuum of emergency care in the existing EMS system. The table of references below illustrates the manner in which the program is achieving those goals and is moving towards greater magnitudes of improved outcomes.

The EMS for Children program supports improved outcomes from health care services delivery for children who have sustained illness or trauma through programs that support prehospital and hospital based clinical care delivery, enhance infrastructures to support the needs of children, drive innovation/research and translation of new knowledge/research findings, and enhance the workforce of skilled personnel who can deliver care for children in urgent/emergent care settings. EMS for Children specifically creates economies of scale through programs and structures that can maximize the ability of communities and states to tailor to their own local needs improvement strategies derived from national experts that otherwise would not be available locally or in their own state.

Evidence from research:

The following table demonstrates current literature reflecting upon the EMSC Performance Measures, SPROC, Targeted Issues grants, the Pediatric Emergency Care Applied Research Network and the EMS for Children Innovation and Improvement Center. The summary listed in blue represent evidence interpretation for academicians. The categorization within the summaries is adapted from the National Quality Forum's domains for metrics assessment: scientific acceptability, usability, feasibility, and importance: http://www.qualityforum.org/Measuring_Performance/Submitting_Standards/Measure_Evaluation_Criteria.aspx)

The summary listed in yellow represents the interpretation of evidence for all stakeholders.

Of note, the development of evidence post intervention would be expected to take many years after the intervention has occurred and the manuscript is developed and published. Ranges are estimated in excess of 3 years with many studies of the intervention (collection of data and writing) itself adding to the time frame. Thus, the emergence of literature lags 3-5 years behind the *adoption* of the measure and institution of interventions to align to the measure. The creation of the EMSC Innovation and Improvement Center in midyear 2016 is intended to accelerate both interventions (through rapid cycle process improvement and QI collaboratives) and dissemination of information (through QI reports, alternative methods of dissemination for scientific uptake, and learning collaboratives) to accelerate QI interventions and knowledge translation for quicker time to outcomes improvement. Thus, it would be anticipated that there would be paucity of published data between the creation of metrics and publication of evidence; yet, there is still a plethora of evidence to demonstrate advancement of the EMS for Children care continuum.

EMSC Performance Measures					
Measure Details		Outcomes	References	Summary	Notes
PM 71	The percent of pre-hospital provider agencies in the	**1)** On-line medical control utilization	**1)** Babl, F., Vinci, R., Baughner, H., & Mottley, L. (2001). Pediatric Pre-Hospital Advanced Life	**1)** "On-line medical control was requested by ALS crews in 154 of 555 transports (27.7%) The most common request for	**Search Terms:** online medical

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EMSC Impact and Outcomes References

EMSC Performance Measures				
Measure Details	**Outcomes**	**References**	**Summary**	**Notes**
State/Territory that have on-line pediatric medical direction. INTERPRETATION: The existence of medical support in an EMS system improves outcomes of care by driving quicker and appropriate interventions, reducing unnecessary ambulance transport and improving evidence based practice. Improving online medical control usage has improved health status. Increased on-line medical control would be expected to improve morbidity and mortality in the pediatric population by more effectively allowing EMS systems to deliver better care aligned with their community and state standards. EVIDENCE SUMMARY: This literature demonstrates Scientific Acceptability and Importance because processes (timeliness) and outcomes (disease specific and cross cutting) improved This literature also demonstrates feasibility of collecting data at the agency level. System change from the PM itself can be extrapolated rather than specifically described in the literature at this juncture in time. However, this is necessary evidence to justify integration into systems for the next level of evidence evaluation on a statewide level (pre/post PM implementation)	**2)** Onset of pain, Thrombolytic therapy **3)** Appropriate use of interventions **4)** Confirmation of stroke diagnosis, rate of thrombolysis, time interval between call and hospital arrival and imaging **5)** Unnecessary ambulance transports **6)** On-scene time, health status **7)** Beneficial intervention not specified in standing orders **8)** Deviations from standing orders	Support Care in an Urban Setting. *Pediatric Emergency Care.17*. 5-9. **2)** Vaisanen, O., Makijarvi, M., Pietila, K., & Silfvast, T. (2006). Influence of medical direction on the management of prehospital myocardial infarction. *Resuscitation*, *70,* 207-214. **3)** Scribano, P., Baker, D., Holmes, J., & Shaw, K. (2000). Use of Out-of-Hospital Interventions for the Pediatric Patient in an Urban Emergency Medical Services System. *Academic Emergency Medicine, 7,* 745-750. **4)** Alhanati, L., Dubourdieu, S., Hoffmann, C., Beguec, F., Travers, S., Lefort, H., Maurin, O., Jost, D., Domanski, L., & Tourtier, J.P. (2014). Stroke: Prospective Evaluation of a Prehospital Management Process Based on Rescuers Under Medical Direction. *American Journal of Emergency Medicine*. *32.* 438-442. **5)** Langabeer, J., Gonzalez, M., Alqusairi, D., Champagne-Langabeer, T., Jackson, A., Mikhail, J., & Persse, D. (2016). Telehealth-Enabled Emergency Medical Services Program Reduces Ambulance Transport to Urban Emergency Departments. *Western Journal of Emergency Medicine. 17.* 713-720. **6)** Erder, M., Davidson, S., & Cheney, R. (1988). On-Line Medical Command in Theory and Practice. *Annals of Emergency Medicine. 18.* 261-268. **7)** Holliman, J., Wuerz, R., Vazquez-de Miguel, G., & Meador, S. (1994). Comparison of Interventions in Prehospital Care by Standing Orders Versus Interventions Ordered by Direct [On-Line] Medical Command. *Prehospital and Disaster Medicine. 9*. 202-209. **8)** Wuerz, R., Swope, G., Holliman, J., & Vazquez-de Miguel, G. (1995). On-Line Medical Direction: A Prospective Study. *Prehospital and Disaster Medicine. 10.* 174-177.	medical control in respiratory emergencies led to the administration of an additional dose of bronchodilator after standing orders. " **2)** "The main finding in this study was that an EMS with dedicated physician involvement was able to reduce the delay from the beginning of pain to initiation of thrombolytic therapy significantly in STEMI patients. Also, thrombolytic therapy was administered to a wider patient group compared to an EMS without physician involvement. Moreover, fewer patients treated by physician EMS complained of chest pain on admission to hospital." **3)** "Online medical command (used in 9% of transports) improved appropriate use of vascular access [OR 8.3 (95% CI=3 to 25) (p<0.001)] and cardiac monitoring [OR=3 (95% CI=1 to 8) (p<0.05)]". **4)** "The prehospital management of stroke by rescuers, under strict medical direction, seemed to be feasible and effective for selection of patients with stroke in an urban environment and may improve the access to thrombolysis." **5)** "A telehealth-enabled emergency medical services program reduced unnecessary ambulance transports by 56% to urban emergency departments, and put paramedic units back in service an average of 44 minutes faster." **6)** "OLMC was associated with an average of an eight minute longer on-scene time, and an infrequent rate of physician-directed deviation from written treatment protocols. OLMC use was associated with improved health status in 5.5% of patients compared with 3.2% for those treated without OLMC. We suggest that targeted OLMC use with expanded paramedic discretion may improve the efficacy of OLMC." **7)** "In 61 cases (6/1%), medical command ordered a potentially beneficial intervention not specified by standing orders or not done by the paramedic. Medical command may improve patient care in about 12% to 14% of cases by ordering conservative care measures for potentially unstable cases (3.1%), giving IV fluid boluses to hypotensive patients (1.7%), checking for hypoglycemia in potentially hypoglycemic patients (1.2%), allowing treatment of persistent, possibly ischemic chest pain with the administration of additional nitroglycerin (1.6%), and using other medications." **8)** "In this study, OLMD altered prehospital therapy in about 20% of the cases, and required about four minutes. The use of	direction, medical direction, online pediatric medical direction, pediatric medical direction, prehospital, online medical command, online medical control, OLMC, OLMD Search Engines: PubMed, Cochrane Search Notes: ~328 titles reviewed, 11 articles pulled for review. Unable to find many recent articles. Only one article found for pediatric population. Some articles argue that online medical direction has not proven any benefit over off-line medical direction, the feasibility of EMS workers calling while providing emergency care, as well as technological issues are discussed as barriers. Some articles provide evidence that online medical direction leads to

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EMSC Performance Measures					
Measure Details		**Outcomes**	**References**	**Summary**	**Notes**
				OLMD appears to prevent errors of omission and improve compliance with regional EMS protocols."	increased length of EMS encounters which could delay time to EC arrival.
PM 72	The percent of pre-hospital provider agencies in the State/Territory that have off-line pediatric medical direction. INTERPRETATION: For both adults and children, EMS protocols (offline medical direction) enhance accuracy and timeliness in care. Due to differences between children and adults, it is essential that prehospital providers have access to protocols that are ideally evidence-based and specifically address the unique needs of children regarding weight-based medication dosing and equipment sizing, differences in management between children and adults based on anatomic and physiologic differences, and disease processes that are only seen in children. Protocols guide providers in their clinical practice and minimize variation in care within an EMS agency. EVIDENCE SUMMARY: Almost identical to the summary above, this literature demonstrates Scientific Acceptability and Importance because processes (timeliness) and outcomes (disease specific and cross cutting) improved	**1)** On-scene time, paramedic-physician agreement on presumptive patient diagnoses, percentage of inappropriate treatment decisions made by paramedics **2)** Morphine administration, documented pain score **3)** Compliance with pain protocol, pain control **4)** Patient and transport characteristics **5)** Barriers to prehospital management of acute pain in children **6)** Adherence to treatment guidelines **7)** Pediatric clinical knowledge **8)** Awareness, supply availability	**1)** Rottman, S., Schriger, D., Charlop, G., Salas, J., & Lee, S. (1997). On-Line Medical Control Versus Protocol-Based Prehospital Care. *Annals of Emergency Medicine. 30*. 62-68. **2)** Brown, K., Hirshon, J., Alcorta, R., Weik, T., Lawner, B., Ho, S., & Wright, J. (2014). The Implementation and Evaluation of an Evidence-Based Statewide Prehospital Pain Management Protocol Developed Using the National Prehospital Evidence-Based Guideline Model Process for Emergency Medical Services. *Prehospital Emergency Care. 18*. 45-51. **3)** Ricard-Hibon, A., Belpomme, V., Chollet, C., Devaud, M., Adnet, F., Borron, S., ...Marty, J. (2008). Compliance With a Morphine Protocol and Effet on Pain Relief in Out-Of-Hospital Patients. *The Journal of Emergency Medicine. 34.* 305-310. **4)** Fullerton-Gleason, L., Crandall, C., & Sklar, D. (2002). Prehospital Administration of Morphine for Isolated Extremity Injuries: A Change in Protocol Reduces Time to Medication. *Prehospital Emergency Care.6.* 411-416. **5)** Murphy, A., Barrett, M., Cronin, J., McCoy, S., Larkin, P., Brenner, M., ...Sullivan, R. (2014). A Qualitative Study of the Barriers to Prehospital Management of Acute Pain in Children. *Prehospital Care. 31.* 493-498. **6)** Francis, R., Bubser, F., Schmidbauer, W., Spies, C., Sorensen, M., Bosse, G., & Kerner, T. (2014). Effects of a Standard Operating Procedure on Prehospital Emergency Care of Patients Presenting with Symptoms of the Acute Coronary Syndrome. *European Journal of Emergency Medicine. 21.* 236-239. **7)** Su, E., Schmidt, T., Mann, C., & Zechnich, A.	**1)** "We found no evidence that prehospital treatment involving protocols was inferior to OLMC for any of these parameters in the three chief complaints. We conclude that the institution of protocols does not increase on-scene times substantially and may shorten them for some clinical complaints. Norton et al found that when paramedics operated by protocol, the accuracy of their clinical assessment was more than double that of those directed by OLMC." **2)** "Our results suggest that incorporation of evidence-based guidelines into a regional prehospital protocol review process can result in improved prehospital care. Specifically, protocol changes with weight-based dosing and optional repeat dosing of morphine resulted in higher total dosing and higher mg/kg dosing without an increase in significant side effects." **3)** "Our results underscore that the protocol for analgesia was often not respected (in about 40% of patients) despite training. This non-compliance with the protocol was associated with a greater rate of inadequate pain relief. In fact, fewer patients experienced pain relief and time for pain relief was significantly lengthened when the titration protocol was not respected. Compliance with the pain protocol needs improvement in the pre-hospital setting, and may result in positive effects on pain relief." **4)** "A change in protocol that permits trained paramedics to administer morphine without physician approval reduces time to analgesia administration without influencing the amount of morphine delivered per patient or the rate of prehospital morphine use. Implementation of the new protocol was associated with a decrease in time between emergency medical services (EMS) arrival on scene and administration of the first dose of morphine from 18.8 to 16.7 minutes, a difference of 2.1 minutes [95% CI 1.3, 2.9]. The proportion of patients receiving analgesia at the scene, rather than during transport, increased from 62.7% before the protocol change to 69.5% after, an increase of 6.8% (95%CI 2.7, 11.0)." **5)** "The global theme 'Understanding Barriers to the Prehospital Management of Acute Pain in Children' emerged from three organizing themes as follows: Advanced Paramedic	**Search Terms:** offline medical direction, medical direction, offline pediatric medical direction, pediatric medical direction, prehospital, pediatric guidelines and prehospital, prehospital clinical practice guidelines Search Engines: PubMed, Cochrane Search Notes: ~368 titles reviewed, 9 articles pulled for review.

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EMSC Performance Measures					
	Measure Details	**Outcomes**	**References**	**Summary**	**Notes**
	This literature also demonstrates feasibility of collecting data at the agency level. System change from the PM itself can be extrapolated on a state wide level based on article 2. Replication of system based change in other states would be expected to demonstrate similar outcomes. Of note, the individuals noted to be driving these activities for statewide engagement/model system development are also drivers for the EMSC PM activities, indicating a cross over in impact of the PM to igniting intervention, study, and knowledge translation.		(2000). A Randomized Controlled Trial to Assess Decay in Acquired Knowledge among Paramedics Completing a Pediatric Resuscitation Course. *Academic Emergency Medicine. 7.* 779-786. **8)** Haskell, S., Kenney, M., Patel, S., Sanddal, T., Altenhofen, K., Sanddal, N., & Atkins, D. (2008). Awareness of Guidelines for Use of Automated External Defibrillators in Children within Emergency Medical Services. *Resuscitation. 76.* 354-359.	(AP) education and training; current clinical practice guidelines for paediatric pain management; realities of prehospital practice. Fear of criticism or interrogation from PED staff of the prehospital treatment given to a child is seen as a contributing factor in some instances on withholding analgesic medications." **6)** "The percentage of cases in whom sublingual nitrate (55.2 vs. 66.7%) or intravenous morphine (26.9 vs. 43.0%) was administered without contraindications was higher after the SOP had been introduced. Therefore, the use of an SOP in prehospital emergency medicine can partly improve the adherence to guideline recommendations. The present study shows that an SOP can potentially affect the quality of patient care including guideline adherent treatment of ACS patients in prehospital emergency medicine." **7)** "Although intensive out-of-hospital pediatric education enhances knowledge, that knowledge rapidly decays. Emergency medical services programs need to find novel ways to increase retention and ensure paramedic readiness." **8)** "After release of the 2005 guidelines, awareness improved significantly in both states but was still significantly greater in Iowa (83% vs. 60%, p<0.002)...Availability of pediatric pads and cables increased significantly in 2006 but remained low in Montana (74% in Iowa vs. 37% in Montana, p<0.001)."	
PM 73	The percent of patient care units in the State/Territory that have essential pediatric equipment and supplies. INTERPRETATION: Every ambulance that either responds to 9-1-1 calls or transports patients between hospitals must have equipment to care for patients of all ages, including infants, children, and adolescents. Since equipment sizes vary in the pediatric population, knowing how to accurately select the appropriate sized equipment and	**1)** Time to medication administration **2)** Seizure control, respiratory complications, admissions **3)** Bag-mask ventilation adequacy during transport **4)** Time to effective ventilation **5)** Accuracy of medication dosing, time to medication administration **6)** Provider knowledge, opinions,	**1)** Stevens, A., Hernandez, C., Jones, S., Moreira, M., Blumen, J., Hopkins, E.,… Haukoos, J. (2015). Color-Coded Prefilled Medication Syringes Decrease Time to Delivery and Dosing Errors in Simulated Prehospital Pediatric Resuscitations: A Randomized Crossover Trial. *Resuscitation. 96.* 85-91. **2)** Holsti, M., Sill, B., Firth, S., Filloux, F., Joyce, s., & Furnival, R. (2007). Prehospital Intranasal Midazolam for the Treatment of Pediatric Seizures. *Pediatric Emergency Care. 23.* 148-153. **3)** Freeman, J., Ciarallo, C., Rappaport, L., Mandt, M., & Bajaj. L.. (2016). Use of Capnographs to Assess Quality of Pediatric Ventilation with 3 Different Airway Modalities. *American Journal of Emergency*	**1)** A novel color-coded, prefilled syringe decreased time to medication administration and significantly reduced critical dosing errors by paramedics during simulated prehospital pediatric resuscitations". **2)** "The IN-MAD midazolam controlled seizures better than PR diazepam in the prehospital setting and resulted in fewer respiratory complications and fewer admissions." **3)** "Capnographs are generated during BMV and are virtually identical to those produced with ETT or LMA ventilation. Attention to capnographs could improve outcomes during emergency treatment and transport of critically ill pediatric patients requiring ventilation with any of these airway modalities." **4)** "In simulated pediatric arrests, the use of laryngeal mask airway, compared with endotracheal tubes, led to more rapid establishment of effective ventilation and fewer complications when performed by prehospital providers." **5)** "Use of a length-based pediatric emergency resuscitation	**Search Terms:** pediatric supplies, prehospital, EMS, pediatric equipment, pediatric emergency equipment Search Engines: PubMed, Cochrane Search Notes: ~314 titles reviewed, 18 articles pulled for review.

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EMSC Impact and Outcomes References

EMSC Performance Measures				
Measure Details	**Outcomes**	**References**	**Summary**	**Notes**
competently use it is also essential. Certain pieces of equipment are necessary to implement life-saving interventions, while others enhance safety of care. Having only adult-sized equipment can impede the ability to provide safe and life-saving therapy to a critically ill or injured child. EVIDENCE SUMMARY: The bulk of this literature demonstrates Scientific Acceptability and Importance because structures (standard lists of equipment) processes (timeliness) and outcomes (disease specific and cross cutting) demonstrate improvement with alignment with the science. This literature also demonstrates feasibility of collecting data at the agency level. System change from the PM itself occurs concurrently with a change in culture for National Pediatric Readiness Project activity, alignment with EMSC driven scientific development (white paper equipment standards developed in conjunction with multiple national societies) and implementation of the PM by the State Partnerships. This is evident in article 11. This cross sectional representation of assessment with a structural and process measure demonstrates capability to change/improve.	and behaviors regarding occupant restraint **7)** Fluid resuscitation speed **8)** Time to task completion, accuracy, recognition of errors **9)** Deviation from recommended medication doses **10)** Insertion failure/success, time to fluid flow, provider comfort, device performance, recommendation **11)** Pediatric equipment availability **12)** Causes of error **13)** Broselow tape accuracy **14)** Accuracy of Enoxaparin dosing	*Medicine. 34.* 69-74. **4)** Chen, L., & Hsiao, A. (2008). Randomized Trial of Endotracheal Tube Versus Laryngeal Mask Airway in Simulated Prehospital Pediatric Arrest. *Pediatrics. 122.* 294-297. **5)** Campagne, D., Young, M., Wheeler, J., & Stroh, G. (2015). Pediatric Tape: Accuracy and Medication Delivery in the National Park Service. *Western Journal of Emergency Medicine. 16.* 665-670. **6)** Johnson, T., Lindholm, D., & Dowd, D. (2006). Child and Provider Restraints in Ambulances: Knowledge, Opinions, and Behaviors of Emergency Medical Services Providers. *Academic Emergency Medicine. 13.* 886-892. **7)** Harvey, G., Foster, G., Manan, A., Thabane, L., & Parker, M. (2013). Factors Affecting Pediatric Isotonic Fluid Resuscitation Efficiency: A Randomized Controlled Trial Evaluating the Impact of Syringe Size. *BMC Emergency Medicine. 13.* 1-10. **8)** Feleke, R., Kalynych, C., Lundblom, B., Wears, R., Luten, R., & King, D. (2009). Color Coded Medication Safety System Reduces Community Pediatric Emergency Nursing Medication Errors. *Journal of Patient Safety. 5.* 79-85. **9)** Shah, A., Frush, K., Luo, X., & Wears, R. (2003). Effect of an Intervention Standardization System on Pediatric Dosing and Equipment Size Determination. *Arch Pediatric Adolescent Medicine. 157.* 229-236. **10)** Fascone, R., Jensen, J., Wewerka, S., & Salzman, J. (2009). Use of the Pediatric EX-IO Needle by Emergency Medical Services Providers. *Pediatric Emergency Care. 25.* 329-332. **11)** Schroeder, L., Alpern, E., Blecher, S., Peska, P., White, M., Shaw, J...Alessandrini, E. (2016). Assessing Structural Quality Elements of Pediatric Emergency Care. *Pediatric*	tape in the prehospital setting was associated with significantly fewer dosing errors and faster time-to-medication administration in simulated pediatric emergencies" **6)** "Improved equipment and education may help providers safely transport pediatric patients...Further, most stated that they would regularly use a child-restraint device that did not interfere with patient care. This implies a need for industry to develop more effective and efficient methods of safely transporting children in ambulances." **7)** "Goal-directed therapy guidelines for pediatric septic shock resuscitation recommend fluid delivery at speeds in excess of that possible through the use of regular fluid infusion pumps...The syringe size used when performing manual pediatric fluid resuscitation has a significant impact on fluid resuscitation speed, in a setting where fluid filled syringes are continuously available. Greatest efficiency was achieved with 30 or 60 mL syringes." **8)** "The CCMS system reduces pediatric medication delay and improves nursing accuracy. This is important in the community ED setting where many children receive emergency care and where providers may lack familiarity with pediatric medication dosing." **9)** "Color coding was associated with a significant reduction in deviation from recommended doses in simulated pediatric emergencies. Numerous potentially clinically significant deviations from recommended doses and equipment sizes were avoided." **10)** "This device has a high insertion success rate with our provider group. Most of our EMS providers also felt comfortable using the device and recommend the device for future use." **11)** "Presence of necessary pediatric emergency equipment is better in the surveyed hospitals than in prior reports. Forty-one percent reported availability of all 113 recommended equipment items. Every hospital reported complete availability of equipment in 77% of the subgroups." **12)** "Most crews struggled to locate essential pediatric equipment. Some mistrusted their intraosseous (IO) injection gun device; others used it incorrectly. We found a wide variety of pediatric equipment organization and storage strategies among the participating agencies...There were several instances of broken pediatric equipment, including BVMs, as a	

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EMSC Impact and Outcomes References

EMSC Performance Measures					
Measure Details		**Outcomes**	**References**	**Summary**	**Notes**
			Emergency Care. 32. 63-68. **12)** Lammers, R., Byrwas, M., & Fales, W. (2012). Root Causes of Errors in a Simulated Prehospital Pediatric Emergency. *Academic Emergency Medicine. 19.* 37-47. **13)** Heyming, T., Bosson, N., Kurobe, A., Kaji, A., Gausche-Hill, M. (2012). Accuracy of Paramedic Broselow Tape Use in the Prehospital Setting. *Prehospital Emergency Care. 16.* 374-380. **14)** Bauman, M.E., Black, K., Bauman, M.L, Belletrutti, M., Bajzar, L., & Massicotte, M.P. (2009). Novel Uses of Insulin Syringes to Reduce Dosing Errors: A Retrospective Chart Review of Enoxaparin Whole Milligram Dosing. *Thrombosis Research. 123.* 845-847.	consequence of this storage configuration." **13)** "Paramedic Broselow weight correlates well with scale weight and ED Broselow weight. Paramedics can use the Broselow tape to accurately determine weight for pediatric patients in the prehospital setting." **14)** "Whole milligram enoxaparin dosing administered via an insulin syringe safely and effectively, achieved therapeutic levels in infants and children. The reduced incidence of enoxaparin dosing errors suggests that whole milligram enoxaparin dosing via an insulin syringe is a method that should be considered for standard of care."	
PM 74	The percent of hospitals with an Emergency Department (ED) recognized through a statewide, territorial or regional standardized system that are able to stabilize and/or manage pediatric medical emergencies. INTERPRETATION: Every day 80K children will seek care in US emergency departments. While many systems are in place to guide EMS, hospitals, and the public about the capability of EDs to care for traumatic injuries and conditions commonly seen in adults (stroke, heart attacks), systems that define the capability of EDs to manage pediatric medical emergencies are widely lacking. This is particularly important because the majority of children are seen in	**1)** Pediatric readiness-WPRS **2)** Pediatric readiness-WPRS **3)** Mortality **4)** Results of the National Pediatric Readiness Project assessment of the 45 HIS/Tribal emergency	**1)** Gausche-Hill, M., Ely, M., Schmuhl, P., Telford, R., Remick, K., Edgerton, E., & Olson, L. (2015). A National Assessment of Pediatric Readiness of Emergency Departments. *JAMA Pediatrics. 169.* 527-534. **2)** Remick, K., Kaji, A., Olson, L., Ely, M., Schmul, P., McGrath, N., …Gausche-Hill, M. (2016). Pediatric Readiness and Facility Verification. *Annals of Emergency Medicine. 67.* 320-328. **3)** Rice, A., Dudek, J., Gross, T., Mars, T., & Woolridge, D. (2017). The Impact of a Pediatric Emergency Department Facility Verification System on Pediatric Mortality Rates in Arizona. *The Journal of Emergency Medicine.* 1-8. **4)** Sadovich, J., Adirim, T., Telford, R., Olson, L. M., Gausche-Hill, M., & Edgerton, E. A. (2017). Pediatric Readiness in Indian Health Service and Tribal Emergency Departments: Results from the National Pediatric Readiness Project. J Emerg Nurs, 43(1), 49-56.	**1)** "Previous assessments of readiness of emergency departments (EDs) have not been comprehensive and have shown relatively poor pediatric readiness, with a reported weighted pediatric readiness score (WPRS) of 55. Among the EDs entered in the analysis...The median WPRS was 68.9 (interquartile range [IQR] 56.1-83.6). The median WPRS increased by pediatric patient volume...The median percentage of recommended pediatric equipment available was 91%...The presence of physician and nurse PECCs was associated with a higher adjusted median WPRS...compared with no PECC...The presence of PECCs increased the likelihood of having all the recommended components, including a pediatric quality improvement process..." **2)** "The median WPRS was 69 (IQR 57.7, 85.9). Pediatric verified EDs had higher WPRS than assessed and nonassessed EDs. The presence of a pediatric readiness verification process, pediatric emergency care coordinator, and quality improvement plan for pediatric emergency care was associated with higher levels of pediatric readiness." **3)** "The implementation of the Arizona pediatric ED verification system was associated with a trend toward lower mortality. These results offer a platform for further research on pediatric ED preparedness efforts and their effects on improved patient outcomes...Facilities certified by the PPEC program saw a	**Search Terms:** pediatric emergency readiness, hospital Search Engines: PubMed, Cochrane Search Notes: ~42 titles reviewed, 3 articles pulled for review.

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EMSC Performance Measures				
Measure Details	**Outcomes**	**References**	**Summary**	**Notes**
emergency departments that see fewer than 15 children per day. The infrequent occurrence of critically ill children in the majority of emergency departments and lack of a dedicated champion to ensure sustained readiness to act, makes maintaining a high level of pediatric readiness difficult. Since the public and the EMS system cannot differentiate pediatric capabilities of EDs, every ED must be ready to care for a child as reflected in the training of its staff, the stocking of equipment, and the implementation of policies that uniquely consider the needs of children. On a regional or statewide level, programs to identify pediatric ready sites have been linked to decreased mortality. EVIDENCE SUMMARY: The evidence illustrated in this summary for this measure demonstrates clear impact of improvement in outcomes with process measures (improvement in readiness scores) and patient related outcomes (decreases in mortality). Moreover, these improvements in outcomes are demonstrated in a temporal relationship with facility recognition. This provides sufficient evidence to support scientific acceptability (relationship to outcomes), importance (linkage to mortality			decrease in injury-related ED mortality between the pre- and post certification time periods." **4)** "This article reports the results of the NPRP assessment in HIS/Tribal emergency departments that, despite service a historically vulnerable population, scored favorably when compared with national data. The survey identified areas for improvement, including implementation of QI processes, stocking of pediatric specific equipment, implementation of policies and procedures on intrerfacility transport, and maintaining staff pediatric competencies."	

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EMSC Performance Measures					
	Measure Details	**Outcomes**	**References**	**Summary**	**Notes**
	as an outcome), feasibility and usability (when tailored to state settings). System change from the PM itself occurred as a driver for these specific state partnerships and engaged champions of the EMSC program initiatives. Moreover, creation of a Facility Recognition Collaborative has occurred with participation of 14 states secondary to the outcomes of this PM institution and demonstration of evidence for outcomes improvement.				
PM 75	The percent of hospitals with an Emergency Department (ED) recognized through a statewide, territorial or regional standardized system that are able to stabilize and/or manage pediatric traumatic emergencies. INTERPRETATION: Traumatic injuries are the leading cause of death in children >1 year of age in the United States. Though systems are often in place to guide EMS, hospitals, and the public about the capability of EDs to care for traumatic injuries as a whole, these systems may not always differentiate the pediatric-specific capability of individual EDs to care for children with traumatic injuries. As a result, this can cause delays for children in receiving definitive care and can lead to unnecessary transfers to more distant facilities because it was unknown that a closer	**1)** Geographic distribution of severely injured patients and relationship to trauma systems **2)** Proportion of injured children treated at pedi trauma centers and benefits	**1)** Ciesla, D., Pracht, E., Cha, J., & Langland-Orban, B. (2011). Geographic Distribution of Severely Injured Patients: Implications for Trauma System Development. *Journal of Trauma Acute Care Surgery. 73.* 618-624. **2)** Myers, S. R., Branas, C. C., French, B., Nance, M. L., & Carr, B. G. (2016). A National Analysis of Pediatric Trauma Care Utilization and Outcomes in the United States. Pediatr Emerg Care. doi: 10.1097/pec.0000000000000902	**1)** "Those in proximity to trauma centers may benefit from improved and secondary triage guidelines and interfacility transfer agreements....This study demonstrated that treatment in a trauma center was associated with a substantial reduction in mortality and cost of care." **2)** "Our results provide the first national evidence that treatment at verified pediatric TCs may improve outcomes, supporting a survival benefit with pediatric trauma verification."	**Search Terms:** pediatric emergency readiness, hospital Search Engines: PubMed, Cochrane Search Notes: ~42 titles reviewed, 3 articles pulled for review. SEARCH ADDITIONS: Need ACS verification literature to search

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EMSC Performance Measures					
	Measure Details	**Outcomes**	**References**	**Summary**	**Notes**
	facility was capable of meeting the treatment needs of a child. Close proximity to a trauma center has been shown to decrease mortality in injured patients, including children. Thus having statewide or regional systems that define the pediatric trauma capabilities of EDs is essential to decreasing morbidity and mortality in children. Evidence Summary: While some of the outcomes can be extrapolated from the above literature on overall pediatric readiness, this PM is marked with an inability to tease out the impact of American College of Surgeons trauma verification. This influences culture and statewide initiatives that make the ability to deal with covariate and confounders for outcomes very challenging. However, correlations are clearly demonstrated in the literature with trauma systems development in general and outcomes of mortality and cost of care.				
PM 76	The percent of hospitals with an Emergency Department (ED) in the State/Territory that have written inter-facility transfer guidelines that cover pediatric patients and that contain all the components as per the implementation manual.	**1)** Discordance between primary reason for transport and discharge diagnosis category **2)** Unplanned events **3)** Hospital length of stay **4)** Characteristics	**1)** Philpot, C., Day, S., Marcdante, K., & Gorelick, M. (2008). Pediatric Interhospital Transport: Diagnostic Discordance and Hospital Mortality. *Pediatric Critical Care Med. 9.* 15-19. **2)** Orr, R., Felmet, K., Han, Y., McCloskey, K., Dragotta, M., Bills, D.,...Watson, S. (2009). Pediatric Specialized Transport Teams are Associated with Improved Outcomes.	**1)** "Discordance between primary reason for transport and diagnosis category is common in the pediatric interhospital transport population and varies by diagnostic category (more frequent in trauma patients and much less frequent in patients with respiratory illness). Patients with diagnostic discordance have higher crude hospital mortality rates. Recognition that specific diagnoses...are more likely to result in discordance should prompt referring and accepting physicians to give particular attention to information obtained and transmitted.	**Search Terms:** pediatric interfacility transfer, interfacility transfer, interfacility transfer guidelines,

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EMSC Impact and Outcomes References

EMSC Performance Measures					
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	INTERPRETATION: When an ED/hospital lacks the necessary resources to care for a child, it is essential that the he/she be transferred to the closest appropriate facility with minimal delays. This means having guidelines that define the process for selecting the appropriate facility, ensuring appropriate staffing of the transport service to match the needs of the child, and having a plan to transfer the patient record. Unnecessary transports are costly and stressful for families and yet delays in transfers and thus time to appropriate resources are potentially dangerous. There are opportunities to enhance safety during patient transport and guide referring facilities in determining when a transfer may or may not be necessary. Having interfacility transferring guidelines for referring EDs has the potential to enhance this process. EVIDENCE SUMMARY: This literature demonstrates Scientific Acceptability and Importance because processes (timeliness) and outcomes (disease specific and cross cutting) improved. Moreover, this data has prompted rigorous study design (RCT, #3) to demonstrate this scientific acceptability with factors	predicting subsequent interfacility transfer to a pediatric trauma center (PTC). **5)** Transfer to an academic PED **6)** Physician notification of a child requiring ICU admission **7)** Length of hospital stay and required ICU interventions **8)** Time sensitive intervention **9)** Preventable transfers **10)** ED resource utilization **11)** Presence of interfacility guidelines/agreements	*Pediatrics. 124.* 40-48. **3)** Stroud, M., Prodhan, P., Moss, M., Fiser, R., Schexnayder, S., & Anand, K. (2010). Enhanced Monitoring Improves Pediatric Transport Outcomes: A Randomized Controlled Trial. *Pediatrics. 127.* 42-48. **4)** Ross, D., Rewers, A., Homan, M., Schullek, J., Hawke, J., & Hedegaard, H. (2012). Factors Associated with the Interfacility Transfer of the Pediatric Trauma Patient. *Pediatric Emergency Care. 28.* 905-910. **5)** Gattu, R., Teshome, G., Cai, L., Wright, C., & Lichenstein, R. (2014). Interhospital Pediatric Patient Transfers-Factors Influencing Rapid Disposition After Transfer. *Pediatric Emergency Care. 30.* 26-30. **6)** Sahyoun, C., Fleegler, E., Kleinman, M., Monuteaux, M., & Bachur, R. (2013). Early Identification of Children at Risk for Critical Care. *Pediatric Emergency Care. 29.* 419-424. **7)** Stroud, M., Sanders, R., Moss, M., Sullivan, J., Prodhan, P., Melguizo-Castro, M., & Nick, T. (2015). Goal-Directed Resuscitative Interventions During Pediatric Interfacility Transport. *Critical Care Medicine. 43.* 1692-1698. **8)** Meyer, M., Gourlay, D., Weitze, K., Ship, M., Drayna, P., Werner, C., & Lerner, B. (2016). Helicopter Interfacility Transport of Pediatric Trauma Patients: Are We Overusing a Costly Resource. *Journal of Trauma Acute Care Surgery. 80.* 313-317. **9)** Fenton, S., Lee, J., Stevens, A., Kimbal, K., Zhang, C., Presson, A.,...Scaife, E. (2016). Preventable Transfers in Pediatric Trauma: A 10-Year Experience at a Level I Pediatric Trauma Center. *Journal of Pediatric Surgery. 51.* 645-648. **10)** Li, J., Monuteaux, M., Bachur, R. (2012). Interfacility Transfers of Noncritically Ill Children to Academic Pediatric Emergency Departments. *Pediatrics. 130.* 83-92.	It may also direct the transport team to be more vigilant in ongoing assessments during transport. " **2)** "Transport of critically ill children to a pediatric tertiary care center can be conducted more safely with a pediatric critical care specialized team than with teams lacking specific training and expertise in pediatric critical care and pediatric transport medicine. This study substantiated our hypothesis that interfacility transport performed by a pediatric critical care specialized team would be associated with improved survival rates and fewer unplanned events during transport." **3)** "Results from this prospective randomized trial suggest that enhanced monitoring during pediatric interfacility transport leads to increased interventions in the out-of-hospital setting. Improved monitoring during pediatric transport has the potential to improve outcomes of critically ill children." **4)** "Factors highly associated with transfer of an injured child from a non-PTC to a PTC included younger age, burns, non-accidental trauma, head/neck injury, and multiple injuries in younger children. If prehospital pediatric trauma triage functioned ideally, there would be neither undertriage or overtriage." **5)** "Pediatric patients transferred from outlying community EDs to a PED frequently required little or no additional care. Referring hospital ED type and physician training type are associated with the need for additional workup at the pediatric emergency room." **6)** "A standardized communication template for inter-ED transfers can identify children with respiratory complaints who required ICU admission." **7)** "The present study is the first to provide evidence that the use of goal-directed therapy by specialized pediatric transport teams in the field improves the outcomes of critically ill children". **8)** "This study suggests an overuse of Helicopter emergency medical services (HEMS) for interfacility transfer of injured pediatric patients to a PTC. Although these patients likely required the resources of a PTC, they could perhaps have been transported by ground ambulance without detriment. Further research is needed to investigate how interfacility transport modes are selected and if these decisions can be improved without increasing evaluation times at transferring facilities." **9)** "A significant number of pediatric trauma transfers can be	interfacility transfer policies. Search Engines: PubMed, Cochrane Search Notes: ~57 titles reviewed, 11 articles pulled for review.

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EMSC Performance Measures					
	Measure Details	**Outcomes**	**References**	**Summary**	**Notes**
	important to the scientific community that relate to this PM. This literature also demonstrates feasibility of collecting data at the hospital and aggregate system level (state and national data). System change from the PM itself can only be extrapolated as this body of evidence illustrates gaps in system based guideline delivery, compliance with process measures, and current state of gaps in outcomes related to effectiveness of care for those transferred. Direct relationship of the PM with time series studies has not yet been described but foundational evidence to support it is being added to the evidence pool as described.		**11)** Fendya, D., Genovesi, A., Belli, K., Page, K., & Vernon, D. (2011). Organized Interfacility Transfer Processes An Opportunity to Improve Pediatric Emergency Care. *Pediatric Emergency Care. 27.* 900-906.	classified as preventable. Reducing preventable transfers could offer opportunities for improving value in a trauma care system." **10)** "A significant proportion of interfacility transfers to academic pediatric EDs is discharged directly from the ED or is admitted for less than a day. These patients and their clinical outcomes provide insight into the educational needs and medical capabilities of referring hospitals and clinicians." **11)** " Organized processes for interfacility transfer of ill or injured children were not established for a sizable proportion of survey hospitals. Addressing this void may provide an opportunity to improve the emergency care of children. Only 13% of hospitals had interfacility guidelines containing all recommended components. No defined interfacility transfer process or guidelines were in place in 46% of the data-set hospitals."	
PM 77	The percent of hospitals with an Emergency Department (ED) in the State/Territory that have written inter-facility transfer agreements that cover pediatric patients. INTERPRETATION: When an ED determines that it is necessary to seek a higher level of care for a pediatric patient, it is essential that the patient be transferred in a seamless manner. Having interfacility transfer agreements in place between hospitals can help minimize delays in transfer. EVIDENCE SUMMARY: This literature demonstrates Scientific Acceptability of the	**1)** Presence of interfacility guidelines/agreements **2)** Geographic distribution of severely injured patients	**1)** Fendya, D., Genovesi, A., Belli, K., Page, K., & Vernon, D. (2011). Organized Interfacility Transfer Processes An Opportunity to Improve Pediatric Emergency Care. *Pediatric Emergency Care. 27.* 900-906. **2)** Ciesla, D., Pracht, E., Cha, J., & Langland-Orban, B. (2011). Geographic Distribution of Severely Injured Patients: Implications for Trauma System Development. *Journal of Trauma Acute Care Surgery. 73.* 618-624.	**1)** "Fourteen states have legislative mandates requiring interfacility transfer guidelines and agreements….It has been estimated that 89% of pediatric emergency visits are to ED's associated with general hospitals, rather than dedicated children's hospitals....transfer of children from receiving ED's to pediatric specialty facilities is an essential component of pediatric emergency care. Advanced planning is best illustrated by the existence of established guidelines and agreements between referring and receiving hospitals". **2)** "Those in proximity to trauma centers may benefit from improved and secondary triage guidelines and interfacility transfer agreements....This study demonstrated that treatment in a trauma center was associated with a substantial reduction in mortality and cost of care."	**Search Terms:** pediatric interfacility transfer agreements, interfacility transfer agreements Search Engines: PubMed, Cochrane Search Notes: ~ 16 titles reviewed, 2 articles pulled for review.

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EMSC Impact and Outcomes References

EMSC Performance Measures					
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	measure to relate to all cause pediatric transfers, however, specific association with trauma and relationship with transfer agreements is described in the evidence outlined. Importance is implied in the significance of the outcomes. System change from the PM itself can only be extrapolated in association with a temporal relationship with the PM but as previously stated, this represents not strategic effort but cultural effort, thus is multi-factorial and the EMSC efforts represent a significant portion of these efforts given the direct relationship with the supporting societies and state partnership championing these causes.				

EMSC's Target Issue Grants						
State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
NH	Geisel School of Medicine and Dartmouth-Hitchcock Medical Center	Scott Rodi, MD	N/A	N/A	N/A	**Search Terms:** Scott Rodi, Prehospital Pediatric Care **Results:** 5 **Notes:** None applicable to pediatric emergency services
NY	Hofstra North Shore-LIJ School of Medicine at Hofstra University	Robert Silverman, MD, MS	N/A	N/A).	N/A	**Search Terms:** Robert Silverman, Pediatric, POSTSAC, Prehospital oral steroids, Status asthmaticus **Results:** 40 **Notes:** None applicable to pediatric emergency services before 2012.
KY	University of Louisville Research Foundation	Mary Fallat, MD	**1)** Communication performance	**1)** Calhoun, A., Sutton, E., Barbee, A., McClure, B., Bohnert, C., Forest, R., …Fallot, M. (2017). Compassionate Options for Pediatric EMS (COPE):	**1)** "These results suggest that an EMS-centric app containing guiding information regarding compassionate communication skills can be effectively used by EMS providers to self-debrief after difficult events in the absence of a live	**Search Terms:** Mary Fallat, Compassionate Options for Pediatric EMS **Results:** 73

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EMSC Impact and Outcomes References

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State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
			2) Metrics for mortality and non-mortality outcomes **3)** Pediatric supply availability **4)** Survival after emergency department thoracotomy **5)** Variability in structure and care processes for critically injured children **6)** Competencies to help cope with OOH death	Addressing Communication Skills. *Prehopsital Emergency Care. 21.* 334-343 **2)** Flynn-O'Brien, K., Fallat, M., Rice, T., Gall, C., Nance, M., Upperman, J., …& Rivara, F. (2017). Pediatric Trauma Assessment and Management Database: Leveraging Existing Data Systems to Predict Mortality and Functional Status after Pediatric Injury. *Journal of the American College of Surgeons. 224.* 933-944. **3)** Costick, J., Fallat, M., Scaggs, M., & Bartlett, R. (2013). Pilot Statewide Study of Pediatric Emergency Department Alignment With National Guidelines. *Pediatric Emergency Care. 29.* 806-807. **4)** Flynn-O'Brien, K., Stewart, B., Fallat, M. Maier, R., Arbabi, S., Rivara, F., & McIntyre, L. (2016). Mortality After Emergency Department Thoracotomy for Pediatric Blunt Trauma: Analysis of the National Trauma Data Bank 2007-2012. *Journal of Pediatric Surgery. 51.* 163-167. **5)** Flynn-O'Brien, K., Thompson, L., Gall, C., Fallat, M., Rice, T., &Rivara, F. (2016). Variability in the Structure and Care Processes for Critically Injured Children: A Multicenter Survey of Trauma Bay and Intensive Care Units. *Journal of Pediatric Surgery. 51.* 490-498. **6)** Fallat, M. E., Barbee, A. P., Forest, R., McClure, M. E., Henry, K., & Cunningham, M. R. (2016). Family Centered Practice During Pediatric Death in an Out of Hospital Setting. Prehosp Emerg Care, 20(6), 798-807.	facilitator, significantly altering their near-term communication patterns." **2)** "Merging 2 data systems allowed for improve risk-adjusted modeling for mortality and functional status. The merged database allowed for patient evaluation throughout the care continuum on a multi-institutional level. Merging existing data is feasible, innovative, and has potential to impact care with minimal new resources." **3)** "Kentucky facilities were reasonable well equipped by nation standards, but rural facilities and small hospitals did not stock the smallest equipment sizes because of low reported volume of pediatric emergency department cases…Grant proposals were received from 28 facilities in the first 3 months of funding availability." **4)** "Usual indicators for EDT after blunt trauma in adults may not apply in children, and use should be discouraged without compelling evidence of a reversible cause of extremis." **5)** "Variability exists in structure and care processes for critically injured children. Further investigation of variation and its causal relationship to outcomes is warranted to provide optimal care." **6)** "The study revealed effective ways for EMS providers to interact with distressed family members during an OOH pediatric death."	**Notes:** Only included studies published from 2012 and on with pediatric EMS components.
IN	Indiana University INTERPRETATION: 1. Education of prehospital EMS	**A)** Andrew Stevens, MD	**1)** Pediatric violent injuries **2)** Child passenger	**1)** Walthall, J., Burgess, A., Weinstein, E., Miramonti, C., Arkins, T., & Wiehe, S. (2016). Descriptive Correlates of Urban Pediatric Violent Injury Using Emergency	**1)** "Pediatric violent injuries occurred in identifiable geographic and temporal patterns. This has implications for injury prevention programming to prioritize highest-risk areas."	**Search Terms:** Andrew Stevens, Prehospital, Pediatric, Asthma, Elizabeth Weinstein **Results:** 91

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EMSC Impact and Outcomes References

EMSC's Target Issue Grants						
State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
	personnel can be accomplished to reduce mortality and morbidity by effectively securing patients during transport in ambulances .	**B)** Elizabeth Weinstein	restraint practices	Medical Service Patient-Level Data. *Pediatric Emergency Care. 00.* 1-7. **2)** O'Neil, J., Steele, G., Weinstein, E., Collins, R., Talty, J., & Bull, M. (2014). Ambulance Transport of Noncritical Children: Emergency Medical Service Providers' Knowledge, Opinions, and Practice. *Clinical Pediatrics. 53.* 250-255.	**2)** "Study findings supports education and training of EMS personnel to improve the safe ambulance transport of children."	**Notes:** Only included studies published from 2012 and on with pediatric EMS components.
TX	Baylor College of Medicine and Texas Children's Hospital INTERPRETATION: 2. Emergency helicopter transport providers can be trained with a pediatric respiratory curriculum. INTERPRETATION: 3. Identification of important research priorities can maximize the value of research grants and government spending on healthcare research. INTERPRETATION: 4. Factors predicting appropriate opiate usage in the	Manish Shah, MD	**1)** Education of prehospital providers **2)** Pediatric respiratory distress and failure knowledge **3)** Pediatric prehospital research priorities **4)** Prehospital opioid analgesia administration **5)** Creation of EBGs **6)** Pediatric outcomes after simulation-based training **7)** Pediatric coordination **8)** Perceptions on providing patient and	**1)** Ngo, T., Belli, K., & Shah, M. (2014). EMSC Program Manager Survey on Education of Prehospital Providers. *Prehospital Emergency Care. 18.* 424-428. **2)** Miller, J., Thammasitboon, S., Hsu, D., Shah, M., Minard, C., & Graf, J. (2016). Continuing Medical Education for Air Medical Providers. *Pediatric Emergency Care. 32.* 87-92. **3)** Browne, L., Shah, M., Studnek, J., Farrell, B., Mattrisch, L., Reynolds, S….& Lerner, E. (2016). 2015 Pediatric Research Priorities in Prehospital Care. *Prehospital Emergency Care. 20.* 311-316 **4)** Browne, L., Studnek, J., Shah, M., Brousseau, D., Guse, C., & Lerner, E. (2016). Prehospital Opioid Administration in the Emergency Care of Injured Children. *Prehospital Emergency Care. 20.* 59-65. **5)** Brown, K., Macias, C., Dayan, P., Shah, M., Weik, T., Wright, J., & Lang, E. (2014). The Development of Evidence-Based Prehospital Guidelines Using a GRADE-based Methodology. *Prehospital Emergency Care.* Retrieved from http://www.tandfonline.com.ezproxyhost.library.tmc.edu/doi/full/10.3109/10903127.2013.844871 **6)** Shah, M., Carey, J., Rapp, S., Masciale, M., Alcanter, W., Mondragon, J., …& Doughty, C. (2016). Impact of High-Fidelity Pediatric Simulation on Paramedic	**1)** "Specified pediatric education hours exist in more states and territories for recertification (63-67%) than initial certification (41%). Limitations in funding, time, instructors, and accessibility are barriers to enhancing pediatric education." **2)** "The curriculum was associated with a short term increased knowledge regarding pediatric respiratory distress and failure for emergency helicopter transport providers and could be used as an alternative model to develop standardized ongoing medical education in pediatrics. Further work is needed to achieve knowledge retention in this learner population." **3)** "This project developed a list of relevant, specific, and important research priorities for pediatric prehospital care. Some similarities exist between this project and prior research agendas but this list represents a current, more specific research agenda and reflects the opinions of working EMS providers, researchers, and leaders." **4)** "Despite implementation of several best practice recommendations to improve prehospital pain treatment, few children have a documented pain score and even fewer receive opioid analgesia. Children with longer transport times, successful IV placement, and/or documentation of pain score(s) were more likely to receive prehospital analgesia." **5)** "The National Prehospital EBG Model Process can be used to create credible, transparent, and usable prehospital evidence-based guidelines. We suggest that a centralized or regionalized approach be used to create and maintain a full set of prehospital EBGs as a means of optimizing resource use."	**Search Terms:** Manish Shah, Shah MI, Pediatric **Results:** 38 **Notes:** Only included studies published from 2012 and on with pediatric EMS components.

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	prehospital setting were described. INTERPRETATION: 5. A standardized method for creating prehospital protocols for tailoring to the needs of communities and states for health care delivery was created. INTERPRETATION: 6. Simulation based training for prehospital personnel can provide optimal care (e.g.training for optimal medication delivery) for children with seizures. INTERPRETATION: 7. Pediatric coordination should be integrated into the EMS system to provide high quality health outcomes (e.g. reducing morbidity and mortality)		family centered care **9)** Minimum standards of emergency care **10)** Opiate administration and documentation **11)** Criterion standard definition for highest-level pediatric trauma team activation protocols **12)** Characteristics of testicular torsion **13)** Pediatric prehospital opioid analgesia administration	Seizure Management. *Prehospital Emergency Care. 4.* 499-507. **7)** Remick, K., Gross, T., Adelgais, K., Shah, M., Leonard, J., & Gausche-Hill, M. (2017). Resource Document: Coordination of Pediatric Emergency Care in EMS Systems. *Prehospital Emergency Care. 21.* 399-407. **8)** Ayub, E., Sampayo, E., Shah, M., & Doughty, C. (2017). Prehospital Providers' Perceptions on Providing Patient and Family Centered Care. *Prehospital Emergency Care. 21.* 233-241. **9)** Glomb, N., Shah, M., & Cruz, A. (2017). Prioritising Minimum Standards of Emergency Care for Children in Resource-Limited Settings. *Paediatrics and International Child Health.* 37. 116-120. **10)** Browne, L., Shah, M., Studnek, J., Ostermayer, D., Reynolds, S., Guse, C., …& Lerner, E. (2016). Multicenter Evaluation of Prehospital Opiod Pain Management in Injured Children. *Prehospital Emergency Care. 20.* 759-767. **11)** Lerner, B., Drendel, A., Falcone, R., Weitze, K., Badawy, M., Cooper, A., …& Shah, M.N. (2015). A Consensus-Based Criterion Standard Definition For Pediatric Patients Who Needed the Highest-Level Trauma Team Activation. *Journal of Trauma and Acute Care Surgery. 78.* 634-638. **12)** Shah, M., Caviness, C., & Mendez, D. (2013). Prospective Pilot Derivation of a Decision Tool for Children at Low Risk for Testicular Torsion. *Academic Emergency Medicine. 20.* 271-278. **13)** Shah MI, Macias CG, Dayan PS, Weik TS, Brown KM, Fuchs SM, Fallat ME, Wright, JL, Lang ES. An Evidence-Based Guideline for Pediatric Prehospital Seizure Management Using GRADE Methodology.	**6) "**Blood glucose was slightly more likely to be checked by trained than untrained paramedics (OR = 1.35, 95% CI 0.72-2.51). Overall, 58% received an indicated dose of midazolam, and this was slightly more likely in the trained than untrained paramedics (OR = 1.39, 95% CI 0.77-2.49)….Simulation-based training on pediatric seizure management may have utility. Data support the need to optimize the route and dose of midazolam for seizing children. Blood glucose measurement in seizure protocols may warrant reprioritization due to low hypoglycemia prevalence." **7)** "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. " **8)** "Based on debriefings from simulated scenarios, some prehospital providers identified the provision of emotional support and effective communication as important components to the delivery of Patient and Family Center Care (PFCC). Other providers revealed several perceived barriers to providing PFCC, though potential solutions to overcome many of these barriers were also identified. These findings can be utilized to integrate effective communication and emotional support techniques into EMS protocols and provider training to overcome perceived barriers to PFCC in the prehospital setting." **9)** "Experts with experience in acute care of children in resource-limited settings have prioritized standards for pediatric emergency care. They identified 26 variables in nine domains from the original IFEM list of standards and two additional free text standards for the care of acutely ill children. This list may serve as a helpful guide for emergency	

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	INTERPRETATION: 10. Appropriate dosing and method of opiate delivery in prehospital settings was assessed.			Prehospital Emergency Care. Jan 2014; 18 (Suppl 1): 15-24. PMID: 24298939	centers to provide medical treatment for acutely ill children in resource-limited settings." **10)** "The proportion of injured children who receive prehospital opioid analgesia remains suboptimal despite implementation of best practice recommendations. Frequency of pain severity assessment of injured children is low. Intranasal fentanyl administration may be an underutilized modality of prehospital opiate administration." **11) "**A criterion standard definition for highest-level pediatric trauma team activation was developed. This criterion standard definition will advance trauma research by allowing investigators to determine the accuracy and effectiveness of highest-level pediatric trauma team activation protocols." **12)** "Based on a decision tool derived with recursive partitioning, study patients with all of the following characteristics had no risk of testicular torsion: normal testicular lie, lack of nausea or vomiting, and age 0 to 10 years. Future research should focus on externally validating this tool to optimize emergent evaluation when testicular torsion is likely, while minimizing routine sonographic evaluation when patients are unlikely to have a serious condition requiring immediate management." **13)** "Using GRADE methodology, we have developed a pediatric seizure guideline that emphasizes the role of capillary blood glucometry and the use of buccal, IM, or intranasal benzodiazepines over IV or rectal routes. Future research is needed to compare the effectiveness and safety of these medication routes."	
	INTERPRETATION: 13. A standardized protocol for managing seizures was developed that can support care delivery in community and state EMS systems.					

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EMSC's Target Issue Grants						
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WI	Mdical College of Wisconsin. The Charlotte, Houston, and Milwaukee Prehospital (CHaMP) Research Node INTERPRETATION: 2. Provided better understanding of the use of opioids in pain management in children, which can optimize the opioid use for improved outcomes. INTERPRETATION: 4. Identification of ways to improve field triage guidelines, which can help local EMS providers in taking children to the best place for care. This can lead to improved health outcomes for local communities.	**A)** Brooke Lerner, PhD **B)** Brittany Farrell	**1)** Paired EMS and ED provider observations of children cared for after blunt trauma **2)** Opiate administration and documentation **3)**Criterion standard definition for highest-level pediatric trauma team activation protocols **4)** Accuracy of the Physiologic Criteria of the Field Triage Guidelines **5)** Helicopter emergency medical services (HEMS) utilization **6)** Reliability and validity of the Assessment of Sport-Related Concussion	**1)** Ahmad, F., Schwartz, H., Browne, L., Lassa-Claxton, S., Wallendorf, M., Lerner, B., & Leonard, J. (2017). Methods for Collecting Paired Observations From Emergency Medical Services and Emergency Department Providers for Pediatric Cervical Spine Injury Risk Factors. *Academic Emergency Medicine. 24.* 432-441 **2)** Brown, L., Shah, M., Studnek, J., Ostermayer, D., Reynolds, S., Guse, C., …& Lerner, E. (2016). Multicenter Evaluation of Prehospital Opiod Pain Management in Injured Children. *Prehospital Emergency Care. 20.* 759-767. **3)** Lerner, B., Drendel, A., Falcone, R., Weitze, K., Badawy, M., Cooper, A., …& Shah, M.N. (2015). A Consensus-Based Criterion Standard Definition For Pediatric Patients Who Needed the Highest-Level Trauma Team Activation. *Journal of Trauma and Acute Care Surgery. 78.* 634-638. **4)** Lerner, E. B., Drendel, A. L., Cushman, J. T., Badawy, M., Shah, M. N., Guse, C. E., & Cooper, A. (2017). Ability of the Physiologic Criteria of the Field Triage Guidelines to Identify Children Who Need the Resources of a Trauma Center. Prehosp Emerg Care, 21(2), 180-184. doi: 10.1080/10903127.2016.1233311 10.1097/ta.0000000000000543 **5)** Meyer, M. T., Gourlay, D. M., Weitze, K. C., Ship, M. D., Drayna, P. C., Werner, C., & Lerner, E. B. (2016). Helicopter interfacility transport of pediatric trauma patients: Are we overusing a costly resource? J Trauma Acute Care Surg, 80(2), 313-317. doi: 10.1097/ta.0000000000000904 **6)** Nelson, L. D., LaRoche, A. A., Pfaller, A. Y., Lerner, E. B., Hammeke, T. A.,	**1)** "Our method of data collection demonstrates the ability to prospectively capture paired observations from EMS and ED personnel for children undergoing evaluation after blunt trauma. While this methodology will be used to implement and evaluate a CSI tool in future studies, it may also be adapted to studies requiring prospective data collection from EMS and ED personnel." **2)** "The proportion of injured children who receive prehospital opioid analgesia remains suboptimal despite implementation of best practice recommendations. Frequency of pain severity assessment of injured children is low. Intranasal fentanyl administration may be an underutilized modality of prehospital opiate administration." **3) "**A criterion standard definition for highest-level pediatric trauma team activation was developed. This criterion standard definition will advance trauma research by allowing investigators to determine the accuracy and effectiveness of highest-level pediatric trauma team activation protocols." **4)** "The Physiologic Criteria are a moderate predictor of trauma center need for children. Missing or inaccurate vital signs may be limiting the predictive value of the Physiologic Criteria. This information may be important when considering how to improve the field triage guidelines, especially when making designation decisions for injured pediatric patients." **5)** "This study suggests an overuse of HEMS for interfacility transfer of injured pediatric patients to a PTC."	**Search Terms:** Brooke Lerner, Lerner EB, Pediatric, Brittany Farrell **Results:**43 **Notes:** Only included studies published from 2012 and on with pediatric EMS components.

The EMSC Innovation & Improvement Center (EIIC) is supported in part by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) Maternal and Child Health Bureau Emergency Medical Services for Children grant number U07MC29829. This information or content and conclusions are those of the author and should not be construed as the official position or policy of, nor should any endorsements be inferred by HRSA, HHS or the U.S. Government.

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	INTERPRETATION: 6. An overuse of costly helicopter transport was identified, raising an opportunity to reduce healthcare cost. INTERPRETATION: 9. Areas of improvement of training for local EMS providers were identified.		**7)** Agreement between the prehospital GCS score and ED GCS score **8)** Pediatric prehospital patient characteristics **9)** Pediatric prehospital research priorities **10)** Change in under-and over-triage rates **11)** Prehospital opioid analgesia **12)** Study protocol methods paper	Randolph, C., . . . McCrea, M. A. (2016). Prospective, Head-to-Head Study of Three Computerized Neurocognitive Assessment Tools (CNTs): Reliability and Validity for the Assessment of Sport-Related Concussion. J Int Neuropsychol Soc, 22(1), 24-37. doi: 10.1017/s1355617715001101 **7)** Nesiama, J. A., Pirallo, R. G., Lerner, E. B., & Hennes, H. (2012). Does a prehospital Glasgow Coma Scale score predict pediatric outcomes? Pediatr Emerg Care, 28(10), 1027-1032. doi: 10.1097/PEC.0b013e31826cac31 **8)** Drayna, P. C., Browne, L. R., Guse, C. E., Brousseau, D. C., & Lerner, E. B. (2015). Prehospital Pediatric Care: Opportunities for Training, Treatment, and Research. Prehosp Emerg Care, 19(3), 441-447. doi: 10.3109/10903127.2014.995850 **9)** Browne, L., Shah, M., Studnek, J., Farrell, B., Mattrisch, L., Reynolds, S.…& Lerner, E. (2016). 2015 Pediatric Research Priorities in Prehospital Care. *Prehospital Emergency Care. 20.* 311-316 **10)** Lerner, E. B., Cushman, J. T., Drendel, A. L., Badawy, M., Shah, M. N., Guse, C. E., & Cooper, A. (2017). Effect of the 2011 Revisions to the Field Triage Guidelines on Under- and Over-Triage Rates for Pediatric Trauma Patients. Prehosp Emerg Care, 1-5. doi: 10.1080/10903127.2017.1300717 **11)** Browne, L. R., Shah, M. I., Studnek, J. R., Ostermayer, D. G., Reynolds, S., Guse, C. E., . . . Lerner, E. B. (2016). Multicenter Evaluation of Prehospital Opioid Pain Management in Injured Children. Prehosp Emerg Care, 20(6), 759-767. doi: 10.1080/10903127.2016.1194931 **12)** Reynolds, S. L., Studnek, J. R., Bryant, K., VanderHave, K., Grossman, E., Moore, C. G., . . . Runyon, M. S. (2016). Study	**6)** "Overall, our findings suggest that the clinical utility of CNTs in the context of SRC management is maximal very soon (within 24 hr) after injury or after symptom resolution and quite limited at later time points (day 8 and beyond). These findings are consistent with current consensus within the broader community that, although neurocognitive tests can contribute to the overall clinical picture, they should not be considered in isolation or favored over multidimensional clinical assessment approaches." **7)** "Our data showed strong agreement between P and ED GCS scores. Also, there was strong association between P GCS scores and short-term outcomes in children with TBI. The results support the use of GCS in prehospital transport destination guidelines for children with TBI." **8)** "Children made up a small part of EMS providers' clinical practice; those encountered most frequently had respiratory distress, seizures, trauma, or an undefined assessment…Describing EMS providers' interaction with children provides the opportunity to target improvements in pediatric prehospital treatment, training, and research." **9)** "This project developed a list of relevant, specific, and important research priorities for pediatric prehospital care. Some similarities exist between this project and prior research agendas but this list represents a current, more specific research agenda and reflects the opinions of working EMS providers, researchers, and leaders." **10)** "Use of the Field Triage Guidelines for children resulted in an unacceptably high rate of under-triage regardless of the version used…Research is needed to determine how to better assist EMS providers in identifying children who need the resources of a trauma center." **11)** "Despite implementation of several best practice recommendations to improve prehospital pain treatment, few children have a documented pain score and even fewer receive opioid analgesia. Children with longer transport times, successful IV	

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	INTERPRETATION: 13. Assessed the potential to reduce total opioid usage in children.			protocol of a randomised controlled trial of intranasal ketamine compared with intranasal fentanyl for analgesia in children with suspected, isolated extremity fractures in the paediatric emergency department. BMJ Open, 6(9), e012190.	placement, and/or documentation of pain score(s) were more likely to receive prehospital analgesia." **12)** "This study examines the feasibility of a larger, multicenter clinical trial comparing the safety and efficacy of INSD ketamine to IN fentanyl and the potential role for INSD ketamine in reducing total opioid medication usage."	
MD	An EMS Triage Tool for Pediatric Destination Decision Making INTERPRETATION: 1. Proper field triage can help local EMS providers transport children to the best place for care to improve health outcomes for local communities. INTERPRETATION: 2. Standardization of pain management in the ED for sickle cell pain may improve outcomes. (Opiates are commonly used for pain management.)	Jennifer Anders	**1)** Patient outcome **2)** Delay in treatment of sickle pain crisis	**1)** Anders, J., Adelqais, K., Hoyle, J., Olsen, C., Jaffe, D., & Leonard, J. (2014). Comparison of Outcomes for Children with Cervical Spine Injury Based on Destination Hospital from Scene of Injury. *Academic Emergency Medicine. 21.* 55-64. **2)** Lin, S., Strouse, J., Whiteman, L., Anders, J., & Stewart, R. (2016). Improving Quality of Care for Sickle Cell Patients in the Pediatric Emergency Department. *Pediatric Emergency Care. 32.* 14-16.	**1)** "Initial destination from scene (pediatric trauma center vs. local hospital) appears to be associated with neurologic outcome of children with cervical spine injuries. Markers of injury severity (altered mental status and focal neurologic findings) are important predictors of poor outcome in children with cervical spine injuries and should remain the primary guide for prehospital triage to designated trauma centers." **2) "**Pediatric patients with sickle cell pain crises experienced significant delays to initial analgesic medication. A standardized approach to pain management may improve ED management of SCD crises."	**Search Terms:** Jennifer Anders **Results:** 28 **Notes:** Only included studies published from 2012 and on with pediatric EMS components.
MI	The Michigan Pediatric EMS Error Reduction Study (MI-PEERS) INTERPRETATION: 1. Identified differences in outcomes based on field triage results. Proper field triage can help local EMS providers take children to the best	**A)** John Hoyle **B)** William Fales **C)** Dena Smith	**1)** Patient outcome **2)** Factors associated with CT use for children with minor blunt head trauma **3)** Risk of traumatic brain injury	**1)** Anders, J., Adelqais, K., Hoyle, J., Olsen, C., Jaffe, D., & Leonard, J. (2014). Comparison of Outcomes for Children with Cervical Spine Injury Based on Destination Hospital from Scene of Injury. *Academic Emergency Medicine. 21.* 55-64. **2)** Stanley, R., Hoyle, J., Dayan, P., Atabaki, S., Lee, L., Lillis, K., Gorelick M., …& Kuppermann, N. (2014). Emergency Department Practice Variation in Computed Tomography Use for Children	**1)** "Initial destination from scene (pediatric trauma center vs. local hospital) appears to be associated with neurologic outcome of children with cervical spine injuries. Markers of injury severity (altered mental status and focal neurologic findings) are important predictors of poor outcome in children with cervical spine injuries and should remain the primary guide for prehospital triage to designated trauma centers." **2)** "Substantial variation exists in the use of CT for children with minor blunt head trauma not explained	**Search Terms:** John Hoyle, William Fales, Dena Smith **Results:** 35 **Notes:** Only included studies published from 2012 and on with pediatric EMS components.

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	place for care to improve health outcomes for local communities. INTERPRETATION: 2. Assessed the use of diagnostic test in children with head trauma. INTERPRETATION: 3. Assessed the use of diagnostic test in children with head trauma. INTERPRETATION: 5. Ways to improve diagnosis of children with head trauma were investigated. INTERPRETATION: 7. Demonstrated how information obtained by the 911 dispatchers can improve outcomes of care delivered by EMS. INTERPRETATION: 8. Assessed ways to better identify children with head trauma at the ER.		**4)** Accuracy of pediatric Glasgow Coma Scale in preverbal children **5)** Outcomes of children with basilar skull fractures **6)** Traumatic brain injury prevalence in children who vomit after minor blunt head trauma **7)** Accuracy of pediatric weights **8)** Validation of PECARN clinical prediction rules **9)** Complications of pharmacological sedation for cranial CT **10)** Relation between scalp hematoma and TBI **11)** Electronic patient care data	with Minor Blunt Head Trauma. *Journal of Pediatrics. 165.* 1201-1206. **3)** Dayan, P., Holmes, J., Hoyle, J., Atabaki, S., Tunik, M., Lichenstein, R., …& Kuppermann, N. (2015). Headache in Traumatic Brain Injuries from Blunt Head Trauma. *Pediatrics. 135.* 504-512. **4)** Borgialli, D., Mahajan, P., Hoyle, J., Powell, E., Nadel, F., Tunik, M., …&Kuppermann, N. (2016). Performance of the Pediatric Glasgow Coma Scale Score in the Evaluation of Children with Blunt Head Trauma. *Academic Emergency Medicine. 23.* 878-884. **5)** Tunik, M., Powell, E., Mahajan, P., Schunk, J., Jacobs, E., Miskin, M., …& Kuppermann, N. (2016). Clinical Presentations and Outcomes of Children with Basilar Skull Fractures After Blunt Head Trauma. *Annals of Emergency Medicine. 68.* 431-440. **6)** Dayan, P., Holmes, J., Atabaki, S., Hoyle, J., Tunik, M., Lichenstein, R., …& Kuppermann, N. (2014). Association of Traumatic Brain Injuries with Vomiting in Children with Blunt Head Trauma. *Annals of Emergency Medicine.63.* 657-665. **7)** Chassee, T., Reischmann, D., Mancera, M., & Hoyle, J. (2016). Emergency Medical Dispatchers Can Obtain Accurate Pediatric Weights from 9-1-1 Callers. *Prehospital Emergency Care. 20.* 808-814. **8)** Atabaki, S., Hoyle, J., Schunk, J., Monroe, D., Alpern, E., Quayle, K., …& Kuppermann, N. (2016). Comparison of Prediction Rules and Clinician Suspicion for Identifying Children with Clinically Important Brain Injuries After Blunt Head Trauma. *Academy of Emergency Medicine. 23.* 566-575. **9)** Hoyle, J., Callahan, J., Badawy, M., Powell, E., Jacobs, E., Gerardi, M., …&	by patient severity or rates of positive CT scans or clinically important traumatic brain injuries" **3)** "ciTBIs are rare and TBIs on CT are very uncommon in children with minor blunt head trauma when headaches are their only sign or symptom." **4)** "The pediatric GCS for preverbal children was somewhat less accurate than the standard GCS for older children in identifying those with TBI on CT. However, the pediatric GCS for preverbal children and the standard GCS for older children were equally accurate for identifying ciTBI." **5) "**Approximately 1% of children with blunt head trauma have physical examination signs of basilar skull fracture or basilar skull fracture on CT. The latter increases the risk of acute adverse outcomes more than physical examination signs of basilar skull fracture. A CT scan is needed to adequately stratify the risk of acute adverse outcomes for these children. Children with isolated basilar skull fractures are at low risk for acute adverse outcomes and, if neurologically normal after CT and observation, are candidates for ED discharge." **6)** "Traumatic brain injury on CT is uncommon and clinically important traumatic brain injury is very uncommon in children with minor blunt head trauma when vomiting is their only sign or symptom. Observation in the emergency department before determining the need for CT appears appropriate for many of these children." **7) "**EMD were able to obtain pediatric patient weights with relative accuracy for patients 0-7 year old. Using this EMD-obtained weight to carry out a drug dose calculation would be unlikely to result in a clinically significant dose error in the vast majority of cases. Communicating an EMD-obtained weight to EMS crews en route to a pediatric patient offers additional preparation time for drug calculations, which could improve accuracy." **8)** "The PECARN TBI prediction rules had substantially greater sensitivity, but lower specificity, than clinician suspicion of ciTBI for children with minor blunt head trauma. Because CT ordering did not	

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	INTERPRETATION: 10. Recommended ways to better identify children under 2 years with head trauma at the ER. INTERPRETATION: 14. This national survey assessed EMS		**12)** CT use for traumatic brain injuries in patients with ventricular shunts **13)** Prevalence of TBI in patients with posttraumatic seizures **14)** Prehospital medication dosing errors **15)** Errors committed by prehospital care providers **16)** Anaphylaxis medication administration **17)** Anaphylaxis events **18)** Prehospital pediatric dosing errors	Kuppermann, N. (2014). Pharmacological Sedation for Cranial Computer Tomography in Children After Minor Blunt Head Trauma. *Pediatric Emergency Care. 30.* 1-7. **10)** Dayan, P., Holmes, J., Schutzman, S., Schunk, J., Lichenstein, R., Foerster, L., …& Kuppermann, N. (2014). Risk of Traumatic Brain Injuries in Children Younger Than 24 Months with Isolated Scalp Hematomas. *Annals of Emergency Medicine. 64.* 153-162. **11)** Lerner, E., Dayan P., Brown, K., Fuchs, S., Leonard, J., Borgialli, D.,…& Foltin, G. (2014). Characteristics of the Pediatric Patients Treated by the Pediatric Emergency Care Applied Research Network's Affiliated EMS Agencies. *Prehospital Emergency Care. 18.* 52-59. **12)** Nigrovic, L., Lillis, S., Atabaki, S., Dayan, P., Hoyle, J., Tunik, M., …& Kuppermann, N. (2013). The Prevalence of Traumatic Brain Injuries After Minor Blunt Head Trauma in Children with Ventricular Shunts. *Annals of Emergency Medicine. 61.* 389-393. **13)** Badawy, M., Dayan, P., Tunik, M., Lillis, K., Miskin, M., Borgialli, D., …& Bachman, M. (2017). Prevalence of Brain Injuries and Recurrence of Seizures in Children with Posttraumatic Seizures. *Academy of Emergency Medicine. 24.* 595-605. **14)** Hoyle, J., Crowe, R., Bentley, M., Beltran, G., & Fales, W. (2017). Pediatric Prehospital Medication Dosing Errors: A National Survey of Paramedics. *Prehospital Emergency Care. 21.* 185-191. **15)** Lammers, R., Willoughby-Byrwa, M., & Fales, W. (2014). Errors and Error-Producing Conditions During a Simulated, Prehospital, Pediatric Cardiopulmonary	follow clinician suspicion of <1%, these prediction rules can augment clinician judgment and help obviate CT ordering for children at very low risk of ciTBI." **9) "**Pharmacological sedation is infrequently used for children with minor BHT undergoing CT, and complications are uncommon. The variability in sedation medications and frequency suggests a need for evidence-based guidelines." **10) "**In patients younger than 24 months with isolated scalp hematomas, a minority received CTs. Despite the occasional presence of traumatic brain injuries on CT, the prevalence of clinically important traumatic brain injuries was very low, with no patient requiring neurosurgery. Clinicians should use patient age, scalp hematoma location and size, and injury mechanism to help determine which otherwise asymptomatic children should undergo neuroimaging after minor head trauma." **11) "**Despite advances in data definitions and increased use of electronic databases nationally, data aggregation across EMS agencies was challenging, in part due to variable data collection methods and missing data. In our sample, only a small proportion of pediatric EMS patients required prehospital medications or interventions." **12)** "Children with ventricular shunts had higher CT use with similar rates of clinically important traumatic brain injuries after minor blunt head trauma compared with children without ventricular shunts." **13)** "Children with PTS have a high likelihood of TBI on CT, and those with TBI on CT frequently require neurosurgical interventions and frequently have recurrent seizures. Those without TBIs on CT, however, are at low risk of short-term recurrent seizures, and none required neurosurgical interventions. Therefore, if CT-negative and neurologically normal, patients with PTS may be safely considered for discharge from the ED." **14) "**This national survey demonstrated a significant number of paramedics are aware of a pediatric	

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	provider's perception of pediatric medication errors and safety systems designed to prevent them. The findings can help reduce those errors in the future. INTERPRETATION: 15. Identified common errors in the delivery of EMS care, which helps in preventing those errors in the future. INTERPRETATION: 17. Evaluated of the value of the mandate to require schools to stock certain medications. INTERPRETATION: 18. Identified common barriers to proper dose calculation by EMS providers.			Arrest. *Simulation in Healthcare. 9.* 174-183. *Prehospital Emergency Care. 21.* 185-191. **16)** Lammers, R., Willoughby-Byrwa, M., & Fales, W. (2014). Medication Errors in Prehospital Management of Simulated Pediatric Anaphylaxis. *Prehospital Emergency Care. 18.* 295-304. **17)** Steffens, C., Clement, B., Fales, W., Chehade, A., Putman, K., & Swor, R. (2017). Evaluating the Cost and Utility of Mandating Schools to Stock Epinephrine Auto-Injectors. *Prehospital Emergency Care.* 1-4. **18)** 4. Hoyle, J. D., Jr., Sleight, D., Henry, R., Chassee, T., Fales, B., & Mavis, B. (2016). Pediatric Prehospital Medication Dosing Errors: A Mixed-Methods Study. Prehosp Emerg Care, 20(1), 117-124.	dosing error, safety systems specific to pediatric patients are lacking, and that paramedics view pediatric drug cards and eliminating drug calculations as helpful. Pediatric drug-dosing safety in the prehospital environment can be improved." **15)** "We systematically observed many types of errors and identified some of the underlying causes during a simulated, prehospital, pediatric cardiopulmonary arrest. There were numerous, multifactorial, and sometimes, synergistic causes of medication dosing errors. Emergency medical service officials can use these findings to prevent future errors." **16)** "Ninety-five percent of crews (59/62) gave epinephrine, but 27 of those crews (46%) delivered the correct dose of epinephrine in an appropriate concentration and route. Twelve crews (20%) gave a dose that was ≥5 times the correct dose; 8 crews (14%) bolused epinephrine intravenously. Among the 55 crews who gave diphenhydramine, 4 delivered the protocol-based dose. Three crews provided an intravenous steroid, and 1 used the protocol-based dose. " **17) "**In this study, few public school patients received epinephrine for anaphylaxis and the vast majority occurred in communities with rapid ALS response. The direct annual supply cost of the school EAI mandate is substantial." **18)** "The mixed-methods study identified multiple themes that influence prehospital pediatric drug dosing errors from the view of both EMT-Ps and EMS Medical Directors. These include: poor pediatric training, great difficulty with drug calculations, drug packaging that makes dosing difficult, trouble getting a correct patient weight, and infrequent pediatric encounters."	
NC	Pediatric Performance Measures: Improving EMS Care for Time-Critical Illness and Injury	**A)** Jane Brice **B)** Julianne Cyr	**1)** Radiation exposure	**1)** Tepper, B., Brice, J. H., & Hobgood, C. D. (2013). Evaluation of radiation exposure to pediatric trauma patients. J Emerg Med, 44(3), 646-652. doi: 10.1016/j.jemermed.2012.09.035	**1)** "In our study, pediatric trauma patients received on the order of 3-5 years worth of radiation within 24 h. …Pediatric trauma patients are at increased risk compared to not only the average population, but also to their adult counterpart receiving the same studies."	**Search Terms:** Jane Brice, Julianne Cyr **Results Reviewed:** 27 **Notes:** Only included studies published from 2012 and on with pediatric EMS components.

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PA	Advancing Family-Centered Care and Quality Self-Assessment for Pediatric Resuscitation Readiness INTERPRETATION: 2. This study demonstrated the impact of pediatric trauma center on children's survival. INTERPRETATION: 8. Identified ways to improve CPR in children, which could lead to greater survival.	**A)** Myers Sage **B)** Nancy Kassam-Adams	**1)** Reasons for pediatric ED transfers and the professional characteristic of transferring providers **2)** Proportion of injured children treated at pedi trauma centers and benefits **3)** The deployment of an emergency care categorizatio n system **4)** Caregiver perceptions of the decision to transfer to a pediatric ED and the use of telemedicine as an alternative to transfer **5)** Performance in trauma resuscitation **6)** Accuracy and reliability of video	**1)** Li, J., Pryor, S., Choi, B., Rees, C. A., Senthil, M. V., Tsarouhas, N., . . . Bachur, R. G. (2016). Profile of Interfacility Emergency Department Transfers: Transferring Medical Providers and Reasons for Transfer. Pediatr Emerg Care. doi: 10.1097/pec.0000000000000848 **2)** Myers, S. R., Branas, C. C., French, B., Nance, M. L., & Carr, B. G. (2016). A National Analysis of Pediatric Trauma Care Utilization and Outcomes in the United States. Pediatr Emerg Care. doi: 10.1097/pec.0000000000000902 **3)** Myers, S. R., Salhi, R. A., Lerner, E. B., Gilson, R., Kraus, A., Kelly, J. J., . . . Carr, B. G. (2013). A pilot study describing access to emergency care in two states using a model emergency care categorization system. Acad Emerg Med, 20(9), 894-903. doi: 10.1111/acem.12208 **4)** Mollen, C. J., Henien, M., Jacobs, L. M., & Myers, S. (2016). Parent Perceptions on Transfers to Pediatric Emergency Departments and the Role of Telemedicine. Pediatr Emerg Care. doi: 10.1097/pec.0000000000000957 **5)** Gala, P. K., Osterhoudt, K., Myers, S. R., Colella, M., & Donoghue, A. (2016). Performance in Trauma Resuscitation at an Urban Tertiary Level I Pediatric Trauma Center. Pediatr Emerg Care, 32(11), 756-762. doi: 10.1097/pec.0000000000000942 **6)** Hsieh, T. C., Wolfe, H., Sutton, R., Myers, S., Nadkarni, V., & Donoghue, A. (2015). A comparison of video review and feedback device measurement of chest compressions quality during pediatric cardiopulmonary resuscitation. Resuscitation, 93, 35-39. doi: 10.1016/j.resuscitation.2015.05.022	**1)** "Most pediatric interfacility ED transfers are referred by general emergency medicine physicians who often transfer for inpatient admission or subspecialty consultation. Understanding the needs of the community-based ED providers is an important step to forming more collaborative efforts for regionalized pediatric emergency care." **2)** "Our results provide the first national evidence that treatment at verified pediatric TCs may improve outcomes, supporting a survival benefit with pediatric trauma verification." **3)** " Among the pediatric population (age 14 years and younger), 56.2% could reach a pediatric critical care or comprehensive ED, with another 19.5% being able to access an advanced ED within 60 minutes…Using this categorization system, fewer than half of all EDs provide advanced or comprehensive emergency care." **4)** "In this sample, caregivers were comfortable with the decision to transfer their child and identified potential benefits of telemedicine as either an adjunct to or replacement of transfer." **5)** "Our results indicate that types of trainees can benefit from a targeted educational intervention to improve their ability to perform a complete and timely primary and secondary survey on children of various ages." **6)** "Video review measured CC rate accurately; depth and release were not reliably or accurately assessed by video. Future research should focus on the optimal combination of methods for measuring CPR quality." **7)** "However, some have caused lacerations and other injuries in children. Minimizing needle injection time, improving device design, and providing instructions to immobilize the leg before use may decrease the risk of these injuries." **8)** "TI during pediatric CPR results in significant interruptions in chest compressions. Procedural outcomes were not significantly different between attempts with and without compressions paused. In	**Search Terms:** Meyers Sage, Nancy Kassam-Adams **Results Reviewed:** 47 **Notes:** Only included studies published from 2012 and on with pediatric EMS components.

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State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
	INTERPRETATION: 11. Demonstrated the value of an online tool on preventing posttraumatic stress in children after medical events. INTERPRETATION: 14. Improved understanding of how parents support their children after a traumatic event. INTERPRETATION: 15. This study helps identify children at higher risk of mental illness following a medical event.		review in measuring chest compression (CC) quality **7)** Complications of epinephrine autoinjector use in children **8)** Procedural characteristic of tracheal intubation (TI) **9)** Reasons for pediatric interfacility transfers **10)** Adherence to guidelines for CPR **11)** Feasibility and effect size of a self-directed online intervention **12)** Child and parent views of the stressors experienced by children hospitalized for an injury **13)** The latent	**7)** Brown, J. C., Tuuri, R. E., Akhter, S., Guerra, L. D., Goodman, I. S., Myers, S. R., . . . Park, E. (2016). Lacerations and Embedded Needles Caused by Epinephrine Autoinjector Use in Children. Ann Emerg Med, 67(3), 307-315 e308. doi: 10.1016/j.annemergmed.2015.07.011 **8)** Donoghue, A., Hsieh, T. C., Nishisaki, A., & Myers, S. (2016). Tracheal intubation during pediatric cardiopulmonary resuscitation: A videography-based assessment in an emergency department resuscitation room. Resuscitation, 99, 38-43. doi: 10.1016/j.resuscitation.2015.11.019 **9)** Li, J., Pryor, S., Choi, B., Rees, C. A., Senthil, M. V., Tsarouhas, N., . . . Bachur, R. G. (2017). Reasons for Interfacility Emergency Department Transfer and Care at the Receiving Facility. Pediatr Emerg Care. doi: 10.1097/pec.0000000000001116 **10)** Donoghue, A., Hsieh, T. C., Myers, S., Mak, A., Sutton, R., & Nadkarni, V. (2015). Videographic assessment of cardiopulmonary resuscitation quality in the pediatric emergency department. Resuscitation, 91, 19-25. doi: 10.1016/j.resuscitation.2015.03.007 **11)** Kassam-Adams, N., Marsac, M. L., Kohser, K. L., Kenardy, J., March, S., & Winston, F. K. (2016). Pilot Randomized Controlled Trial of a Novel Web-Based Intervention to Prevent Posttraumatic Stress in Children Following Medical Events. J Pediatr Psychol, 41(1), 138-148. doi: 10.1093/jpepsy/jsv057 **12)** Ramsdell, K. D., Morrison, M., Kassam-Adams, N., & Marsac, M. L. (2016). A Qualitative Analysis of Children's Emotional Reactions During Hospitalization Following Injury. J Trauma	children receiving CPR, TI should be performed without pausing chest compressions." **9)** "Approximately 4 of 10 interfacility transfers are discharged by the receiving facility, suggesting an opportunity to provide more comprehensive care at referring facilities." **10)** "CPR in a tertiary pediatric ED frequently met recommended parameters for compression rate, pause duration, and compression fraction. Hyperventilation and failure of C:V coordination were very common." **11)** "This pilot randomized controlled trial provides preliminary evidence that a self-directed online preventive intervention is feasible to deliver, and could have an effect in preventing persistent posttraumatic stress." **12)** "The results of this study provide insight into children's experiences of stressors and concerns related to injuries and subsequent medical treatment." **13)** "These findings suggest that a uni-factorial general-distress model is not the optimal model of capturing the latent structure of ASD symptom profiles in youth and that modifying the current DSM-5 9+ symptom algorithm could potentially lead to a more developmentally sensitive conceptualization." **14)** "The TAST is a promising new research tool, which may help to explicate how parents influence their child's developing appraisals and coping solutions following a PTE." **15)** "This study provides additional evidence that early post-injury screening could identify children at higher risk for persistent PTS symptoms and limited support for predicting post-injury depression. Findings support acute PTS symptoms as key early risk markers." **16)** "Participants' rating of opinion items indicate that nearly all hold opinions favorable to trauma-informed care, with each item rated in a favorable direction by more than 90% of participants."	

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EMSC Impact and Outcomes References

EMSC's Target Issue Grants						
State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
	INTERPRETATION: 19. Determined the reliability of a Spanish-language version of a tool to evaluate stress in children. INTERPRETATION: 21. Determined the reliability of tools to evaluate stress in children after a traumatic medical event. INTERPRETATION: 23. Demonstrated the effectiveness of an online game to alleviate stress in children with a traumatic medical event.		structure of Acute Stress Disorder (ASD) symptoms **14)** Feasibility and validation of the Trauma Ambiguous Situations Tool (TAST) **15)** Risk of later posttraumatic stress (PTS) and depression outcomes **16)** Nurses' views on trauma-informed pediatric nursing care **17)** Prevalence of acute stress disorder symptoms **18)** Psychological symptoms in injured children **19)** Measures of child acute stress **20)** Relationship between	Nurs, 23(4), 194-201. doi: 10.1097/jtn.0000000000000217 **13)** McKinnon, A., Meiser-Stedman, R., Watson, P., Dixon, C., Kassam-Adams, N., Ehlers, A., . . . Dalgleish, T. (2016). The latent structure of Acute Stress Disorder symptoms in trauma-exposed children and adolescents. J Child Psychol Psychiatry, 57(11), 1308-1316. doi: 10.1111/jcpp.12597 **14)** Marsac, M. L., & Kassam-Adams, N. (2016). A novel adaptation of a parent-child observational assessment tool for appraisals and coping in children exposed to acute trauma. Eur J Psychotraumatol, 7, 31879. doi: 10.3402/ejpt.v7.31879 **15)** Kassam-Adams, N., Marsac, M. L., Garcia-Espana, J. F., & Winston, F. (2015). Evaluating predictive screening for children's post-injury mental health: New data and a replication. Eur J Psychotraumatol, 6, 29313. doi: 10.3402/ejpt.v6.29313 **16)** Kassam-Adams, N., Rzucidlo, S., Campbell, M., Good, G., Bonifacio, E., Slouf, K., . . . Grather, D. (2015). Nurses' views and current practice of trauma-informed pediatric nursing care. J Pediatr Nurs, 30(3), 478-484. doi: 10.1016/j.pedn.2014.11.008 **17)** Kassam-Adams, N., Palmieri, P. A., Rork, K., Delahanty, D. L., Kenardy, J., Kohser, K. L., . . . McGrath, C. (2012). Acute stress symptoms in children: results from an international data archive. J Am Acad Child Adolesc Psychiatry, 51(8), 812-820. doi: 10.1016/j.jaac.2012.05.013 **18)** Kassam-Adams, N., Bakker, A., Marsac, M. L., Fein, J. A., & Winston, F. K. (2015). Traumatic Stress, Depression, and Recovery: Child and Parent Responses After Emergency Medical Care for	**17)** "This group of symptoms appears to capture aspects of traumatic stress reactions that can create distress and interfere with children's and adolescents' ability to function in the acute post-trauma phase." **18)** "For about 1 in 6 children and parents, unintentional injury treated in the ED can be associated with negative psychological sequelae and suboptimal recovery." **19)** "The current results expand upon prior validation studies of the English-language versions of the ASC-Kids checklist and the DICA-ASD interview, and provide the first psychometric data regarding the Spanish-language version of each measure. These results provide support for the internal consistency of each measure, and for the checklist's cross-language reliability in a subsample of bilingual children." **20)** "The CAS may be a useful addition to existing screening tools for PTSS among children." **21)** "This study demonstrated that the two very brief measures we are presenting (the ASC-6/CEA-6 with six items and the ASC-3/CEA-3 with three items) performed well as initial screens to estimate current acute PTSS and to detect current ASD status, across several samples of children and adolescents with recent trauma exposure." **22)** "Early interventions designed to prevent or reduce PTSS after pediatric injury may be more successful if they primarily target modifying escape coping behaviors." **23)** "Applying a systematic approach to the development of Coping Coach led to the creation of a functional intervention that is accepted by children and parents. Development of new e-health interventions may benefit from a similar approach." **24)** "Of importance, results suggest that clinicians should obtain information about emotional recovery from both children and parents, as their perceptions often differ."	

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State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
			acute pain and posttraumatic stress symptoms (PTSS) in youth following injury **21)** Identification and evaluation of short forms of the Acute Stress Checklist for Children in English and Spanish **22)** Variables of appraisals and coping in predicting PTSS in children following injury **23)** Coping Coach intervention **24)** The association between coping and acute stress reactions following an injury **25)** Feasibility and efficacy	Unintentional Injury. Pediatr Emerg Care, 31(11), 737-742. doi: 10.1097/pec.0000000000000595 **19)** Kassam-Adams, N., Gold, J. I., Montano, Z., Kohser, K. L., Cuadra, A., Munoz, C., & Armstrong, F. D. (2013). Development and psychometric evaluation of child acute stress measures in Spanish and English. J Trauma Stress, 26(1), 19-27. doi: 10.1002/jts.21782 **20)** Hildenbrand, A. K., Marsac, M. L., Daly, B. P., Chute, D., & Kassam-Adams, N. (2016). Acute Pain and Posttraumatic Stress After Pediatric Injury. J Pediatr Psychol, 41(1), 98-107. doi: 10.1093/jpepsy/jsv026 **21)** Kassam-Adams, N., & Marsac, M. L. (2016). Brief Practical Screeners in English and Spanish for Acute Posttraumatic Stress Symptoms in Children. J Trauma Stress, 29(6), 483-490. doi: 10.1002/jts.22141 **22)** Marsac, M. L., Ciesla, J., Barakat, L. P., Hildenbrand, A. K., Delahanty, D. L., Widaman, K., . . . Kassam-Adams, N. (2016). The role of appraisals and coping in predicting posttraumatic stress following pediatric injury. Psychol Trauma, 8(4), 495-503. doi: 10.1037/tra0000116 **23)** Marsac, M. L., Winston, F. K., Hildenbrand, A. K., Kohser, K. L., March, S., Kenardy, J., & Kassam-Adams, N. (2015). Systematic, theoretically-grounded development and feasibility testing of an innovative, preventive web-based game for children exposed to acute trauma. Clin Pract Pediatr Psychol, 3(1), 12-24. doi: 10.1037/cpp0000080 **24)** Marsac, M. L., Donlon, K. A., Hildenbrand, A. K., Winston, F. K., & Kassam-Adams, N. (2014). Understanding	**25)** "Brief web-based interventions introduced during child hospitalization are a feasible strategy to reach many parents following pediatric injury." **26)** "There appears to be both a need and an opportunity for education initiatives regarding paediatric traumatic stress sin the pre-hospital context." **27)** "More education of ED staff regarding child traumatic stress and psychosocial care appears needed and would be welcomed."	

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EMSC Impact and Outcomes References

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State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
			of a web-based intervention for parents **26)** Prehospital providers' knowledge of traumatic stress in children **27)** ED staff's knowledge of traumatic stress in children	recovery in children following traffic-related injuries: exploring acute traumatic stress reactions, child coping, and coping assistance. Clin Child Psychol Psychiatry, 19(2), 233-243. doi: 10.1177/1359104513487000 **25)** Marsac, M. L., Hildenbrand, A. K., Kohser, K. L., Winston, F. K., Li, Y., & Kassam-Adams, N. (2013). Preventing posttraumatic stress following pediatric injury: a randomized controlled trial of a web-based psycho-educational intervention for parents. J Pediatr Psychol, 38(10), 1101-1111. doi: 10.1093/jpepsy/jst053 **26)** Alisic, E., Tyler, M. P., Giummarra, M. J., Kassam-Adams, R., Gouweloos, J., Landolt, M. A., & Kassam-Adams, N. (2017). Trauma-informed care for children in the ambulance: international survey among pre-hospital providers. Eur J Psychotraumatol, 8(1), 1273587. doi: 10.1080/20008198.2016.1273587 **27)** Alisic, E., Hoysted, C., Kassam-Adams, N., Landolt, M., Curtis, S., Kharbanda, A., …Babl, F. (2016). Psychosocial Care for Injured Children: Worldwide Survey Among Hospital Emergency Department Staff. *The Journal of Pediatrics. 170.* 227-233.		

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EMSC Impact and Outcomes References

EMSC'S SPROC Grants						
State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
AK	Department of Health and Social Services, Trauma Program	**A)** Julie Rabeau RN **B)** Elsie Vaden	N/A	N/A	N/A	**Search Terms:** Julie Rabeau, Rabeau J, Elsie Vaden, Vaden, E. **Results:** 0 **Notes:** None applicable to pediatric emergency services
AZ	Department of Health Services, Maternal and Child Health, Injury Prevention Program INTERPRETATION: 1. Pediatric verification system for ER preparedness in Arizona reduced mortality. INTERPRETATION: 3. Rural children have barriers to access high quality care including mental health services that regionalization of care can address.	Tomi St. Mars, MSN, RN	**1)** Pediatric mortality rates **2)** PPEC certification **3)** Epidemiology of pediatric transfers	**1)** Rice, A., Dudek, J., Gross, T., St. Mars, T., & Woolridge, D. (2017). The Impact of a Pediatric Emergency Department Facility Verification System on Pediatric Mortality Rates in Arizona. *Journal of Emergency Medicine.* 1-8. **2)** Smith, N., St Mars, T., & Woolridge, D. (2016). Arizona's Emergency Medical Services for Children Pediatric Designation System for Emergency Departments. *Journal of Emergency Medicine. 51.* 194-200. **3)** Horeczko, T., Marcin, J., Kahn, J., & Sapien, R. (2014). Urban and Rural Patterns in Emergent Pediatric Transfer: A Call for Regionalization. *Journal of Rural Health. 30.* 252-258.	**1)** "The implementation of the Arizona pediatric ED verification system was associated with a trend toward lower mortality. These results offer a platform for further research on pediatric ED preparedness efforts and their effects on improved patient outcomes." **2)** "PPEC enhances the quality of pediatric emergency preparedness by means of voluntary certification. The primary limitations are sustainability and funding, because an Emergency Medical Services for Children grant has offset the cost until now. The number of member facilities in this designation system is continually growing, and universal recertification shows sustainability." **3)** "Emergency pediatric transfers are uncommon in the United States; transfer rates are similar in urban and rural settings. Rural children have additional obstacles to care, especially in access to emergency mental health services. Programs to study and implement regionalization of care should consider diverse patient populations and target improvement in coordination of care, transfer times, and outcomes."	**Search Terms:** Tomi St. Mars, ST Mars T **Results:** 3 **Notes:** Only included studies published from 2012 and on with pediatric EMS components.
CA	Regents of the University of California, Office of Research, Sponsored Programs INTERPRETATION: 2. This project validated a tool to improve triage of children by nurses, leading to improved outcome.	**A)** Timothy Horeczko, MD, MSCR **B)** James Marcin MD, MPH **C)** Parul Dayal **D)** White Keith	**1)** Demographic and clinical features of children who arrived at EDs by EMS **2)** Accuracy, reliability, and validity of the Pediatric Assessment Triangle (PAT)	**1)** Dayal, P., Horeczko, T., Wraa, C., Karsteadt, L., Chapman, W., Bruhnke, L., …& Marin, J. (2017). Emergency Medical Services Utilization by Children. *Pediatric Emergency Care. R*etrieved from www.pec-online.com. **2)** Horeczko, T., Enriquez, B., McGrath, N. E., Gausche-Hill, M., & Lewis, R. J. (2013). The Pediatric Assessment Triangle: accuracy of its application by nurses in the triage of children. J Emerg Nurs, 39(2), 182-189. doi: 10.1016/j.jen.2011.12.020	**1) "**Children transported to rural EDs via EMS are more ill and use more medical resources compared with those who arrive to the ED by other means of transportation." **2)** "The structured assessment of the initial PAT, as performed by nurses in triage, readily and reliably identifies high acuity pediatric patients and their category of pathophysiology. The PAT is highly predictive of the child's clinical status on further evaluation." **3)** "We found that EPs readily recognized both very well and very ill children who presented to	**Search Terms:** Timothy Horeczko**,** James Marcin, Parul Dayal, White Keith**,** pediatrics **Results:** 75 **Notes:** Only included studies published from 2012 and on with pediatric EMS components.

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EMSC Impact and Outcomes References

EMSC'S SPROC Grants						
State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
	INTERPRETATION: 5. Identified early determinants of level of care needed for children with asthma. INTERPRETATION: 6. This large study identified areas of reducing cost of emergency care for children without compromising quality. INTERPRETATION: 8. Pattern and obstacles of emergency medical transportation for children in rural and urban areas were identified. INTERPRETATION: 9, **11, 12, 13, 14, 15, and 17**. Multiple studies assesses the use of telemedicine to provide emergency medical care to children found that telemedicine can improve care and		**3)** Pediatric cardiac risk **4)** Incidence and corresponding clinical etiologies of pediatric SIRs presenting to the ED **5)** Age-specific objective predictors of hospitalization readily known at triage **6)** Patient characteristics and hospital charges **7)** Demographic and clinical features of children who arrived at general EDs by EMS vs private vehicles **8)** Epidemiology of pediatric transfers from urban and rural EDs **9)** Impact of telemedicine critical care consultation **10)** Insurance influence **11)** Pedi patients admitted directly to the	**3)** Horeczko, T., Park, J. K., Mann, C., & Milazzo, A. (2016). Pediatric Emergency Department Study of Cardiac Risk in the Novel Patient (PED SCReeN). Pediatr Emerg Care. doi: 10.1097/pec.0000000000000655 **4)** Horeczko, T., & Green, J. P. (2013). Emergency department presentation of the pediatric systemic inflammatory response syndrome. Pediatr Emerg Care, 29(11), 1153-1158. doi: 10.1097/PEC.0b013e3182a9e629 **5)** Horeczko, T., & Wintemute, G. J. (2013). Asthma vital signs at triage: home or admission (ASTHmA). Pediatr Emerg Care, 29(2), 175-182. doi: 10.1097/PEC.0b013e3182809a45 **6)** Donofrio, J. J., Horeczko, T., Kaji, A., Santillanes, G., & Claudius, I. (2015). Most routine laboratory testing of pediatric psychiatric patients in the emergency department is not medically necessary. Health Aff (Millwood), 34(5), 812-818. doi: 10.1377/hlthaff.2014.1309 **7)** Dayal, P., Horeczko, T., Wraa, C., Karsteadt, L., Chapman, W., Bruhnke, L., . . . Marcin, J. (2017). Emergency Medical Services Utilization by Children. Pediatr Emerg Care. doi: 10.1097/pec.0000000000001143 **8)** Horeczko, T., Marcin, J. P., Kahn, J. M., & Sapien, R. E. (2014). Urban and rural patterns in emergent pediatric transfer: a call for regionalization. J Rural Health, 30(3), 252-258. doi: 10.1111/jrh.12051 **9)** Labarbera, J. M., Ellenby, M. S., Bouressa, P., Burrell, J., Flori, H. R., & Marcin, J. P. (2013). The impact of telemedicine intensivist support and a pediatric hospitalist program on a community hospital. Telemed J E Health, 19(10), 760-766. doi: 10.1089/tmj.2012.0303	the ED with a new potential diagnosis of a cardiac disorder. The EPs determination of intermediate risk and the immediacy of the need for cardiology involvement was, however, variable." **4)** "Pediatric SIRS is common; its associated clinical contexts include potentially dangerous etiologies; many cases of pediatric SIRS can be recognized in triage; and there is significant heterogeneity in the etiology of pediatric SIRS." **5)** "Diastolic hypertension may serve as an early warning indicator of severity of disease and need for hospitalization." **6)** "In this large retrospective study, we found that high costs were associated with routine evaluation of children presenting to the ED on an involuntary hold. Furthermore, we found that the majority of screening laboratory tests performed on patients with nonconcerning exams had clinically insignificant results." **7)** "Children transported to rural EDs via EMS are more ill and use more medical resources compared with those who arrive to the ED by other means of transportation." **8)** "Emergency pediatric transfers are uncommon in the United States; transfer rates are similar in urban and rural settings. Rural children have additional obstacles to care, especially in access to emergency mental health services." **9)** "Telemedicine consultation between pediatric intensivists and community hospital physicians combined with a pediatric hospitalist program at the community hospital has the potential to improve triage of pediatric patients and reduce the need to transfer patients." **10) "**Children without insurance and those considered as having self-pay are more likely to be transferred to another hospital than to be admitted for inpatient care within the same receiving hospital compared with children with private insurance. This study reinforces ongoing concerns about disparities in the provision of pediatric ED and inpatient care."	

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EMSC'S SPROC Grants						
State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
	reduce cost of car. Children in rural areas can particularly benefit from telemedicine applications. INTERPRETATION: 10. This study found an increase rate of transport to another hospital for uninsured children.		PICU from the EC **12)** Frequency of physician-related medication errors **13)** Quality of care delivered to critically ill and injured children **14)** Severity of illness and outcomes among children admitted to a children's hospital PICU from referring ED **15)** Cost, effectiveness, and return on investment (ROI) of telemedicine consultations **16)** Insurance association with decision to admit or transfer **17)** Appropriateness of hospital admission **18)** Evaluation of the Pediatric Assessment Triangle (PAT)	**10)** Huang, Y., Natalie, J., Kissee, J., Dayal, P., Rosenthal, J., & Marcin, J. (2017). The Association Between Insurance and Transfer of Noninjured Children From Emergency Departments. *Annals of Emergency Medicine. 69.* 108-116. **11)** Dayal, P., Hojman, N., Kissee, J., Evans, J., Natalie, J. Huang, Y.,…& Marcin, J. (2016). Impact of Telemedicine on Severity of Illness and Outcomes Among Children Transferred From Referring Emergency Departments to a Children's Hospital PICU. *Pediatric Critical Care Medicine. 17.* 516-521. **12)** Dharmar, M., Kuppermann, N., Romano, P. S., Yang, N. H., Nesbitt, T. S., Phan, J., . . . Marcin, J. P. (2013). Telemedicine consultations and medication errors in rural emergency departments. Pediatrics, 132(6), 1090-1097. doi: 10.1542/peds.2013-1374 **13)** Dharmar, M., Romano, P. S., Kuppermann, N., Nesbitt, T. S., Cole, S. L., Andrada, E. R., . . . Marcin, J. P. (2013). Impact of critical care telemedicine consultations on children in rural emergency departments. Crit Care Med, 41(10), 2388-2395. doi: 10.1097/CCM.0b013e31828e9824 **14)** Dayal, P., Hojman, N. M., Kissee, J. L., Evans, J., Natale, J. E., Huang, Y., . . . Marcin, J. P. (2016). Impact of Telemedicine on Severity of Illness and Outcomes Among Children Transferred From Referring Emergency Departments to a Children's Hospital PICU. Pediatr Crit Care Med, 17(6), 516-521. doi: 10.1097/pcc.0000000000000761 **15)** Yang, N. H., Dharmar, M., Yoo, B. K., Leigh, J. P., Kuppermann, N., Romano, P. S., . . . Marcin, J. P. (2015). Economic Evaluation of Pediatric Telemedicine	**11) "**The implementation of a telemedicine program designed to assist in the care of seriously ill children receiving care in referring emergency departments was associated with lower illness severity at admission to the PICU. This study contributes to the body of evidence that pediatric critical care telemedicine programs assist referring emergency departments in the care of critically ill children and could result in improved clinical outcomes." **12)** "Pediatric critical care telemedicine consultations were associated with a significantly reduced risk of physician-related ED medication errors among seriously ill and injured children in rural EDs." **13)** "Physician-rated quality of care was higher for patients who received consultations with telemedicine than for patients who received either telephone or no consultation. Telemedicine consultations were associated with more frequent changes in diagnostic and therapeutic interventions, and higher parent satisfaction, than telephone consultations." **14)** "The implementation of a telemedicine program designed to assist in the care of seriously ill children receiving care in referring emergency departments was associated with lower illness severity at admission to the PICU." **15)** "From a health care payer perspective, telemedicine consultations to health care providers of acutely ill and injured children presenting to rural EDs are cost-saving (base-case and more than half of Monte Carlo simulation iterations) or cost-effective compared with telephone consultations." **16)** "Children without insurance and those considered as having self-pay are more likely to be transferred to another hospital than to be admitted for inpatient care within the same receiving hospital compared with children with private insurance."	

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State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
				Consultations to Rural Emergency Departments. Med Decis Making, 35(6), 773-783. doi: 10.1177/0272989x15584916 **16)** Huang, Y., Natale, J. E., Kissee, J. L., Dayal, P., Rosenthal, J. L., & Marcin, J. P. (2017). The Association Between Insurance and Transfer of Noninjured Children From Emergency Departments. Ann Emerg Med, 69(1), 108-116 e105. doi: 10.1016/j.annemergmed.2016.06.007 **17)** Yang, N. H., Dharmar, M., Kuppermann, N., Romano, P. S., Nesbitt, T. S., Hojman, N. M., & Marcin, J. P. (2015). Appropriateness of disposition following telemedicine consultations in rural emergency departments. Pediatr Crit Care Med, 16(3), e59-64. doi: 10.1097/pcc.0000000000000337 **18)** Gausche-Hill, M., Eckstein, M., Horeczko, T., McGrath, N., Kurobe, A., Ullum, L., . . . Lewis, R. J. (2014). Paramedics accurately apply the pediatric assessment triangle to drive management. Prehosp Emerg Care, 18(4), 520-530. doi: 10.3109/10903127.2014.912706	**17)** "Our findings may be reassuring in the context of previous research, suggesting that telemedicine specialty consultations can aid in the delivery of more appropriate, safer, and higher quality of care." **18)** "The PAT is a rapid assessment tool that can be readily and reliably used by paramedics in the prehospital setting. The PAT should be used in conjunction with other assessments but can safely drive initial field management."	
MT	Department of Health and Human Services, Office of Research, Sponsored Programs	**A)** James DeTienne **B)** Robin Suzor AS, BS **C)** Kassie Runsabove	N/A	N/A	N/A	**Search Terms:** James DeTienne, DeTienne J, Robin Suzor, Suzor, R, Kassie Runsabove, Runasbove K **Results:** 0 **Notes:** None applicable to pediatric emergency services
NM	University of New Mexico, Health Science Center, Department of Emergency Medicine	**A)** Robert Sapien, MD **B)** Katherine Schafer, BS **C)** Norman Cooeyate	*	*	*	**Search Terms:** Robert Sapien, Sapien RE, Katherine Schafer, Schafer K, Norman Cooeyate, Cooeyate N. **Results:** 44 **Notes:** Only included studies published from 2012 and on with pediatric EMS components. *Articles by Sapien, included elsewhere with main collaborator.

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EMSC Impact and Outcomes References

EMSC'S SPROC Grants						
State	**Entity**	**PI**	**Outcomes**	**References**	**Summary**	**Notes**
PA	University of Pittsburg, Office of the Provost	Jeremy Kahn, MD, MS	**1)** Success factors and barriers to pediatric emergency telemedicine **2)** Use of and training in emergency ultrasound **3)** Attitudes regarding pedi emergency telemedicine	**1)** Uscher-Pines, L., & Kahn, J. M. (2014). Barriers and facilitators to pediatric emergency telemedicine in the United States. Telemed J E Health, 20(11), 990-996. **2)** Marin, J. R., Zuckerbraun, N. S., & Kahn, J. M. (2012). Use of emergency ultrasound in United States pediatric emergency medicine fellowship programs in 2011. J Ultrasound Med, 31(9), 1357-1363. **3)** Ray, K. N., Felmet, K. A., Hamilton, M. F., Kuza, C. C., Saladino, R. A., et.al. (2017). Clinician Attitudes Toward Adoption of Pediatric Emergency Telemedicine in Rural Hospitals. Pediatr Emerg Care, 33(4), 250-257.	**1)** "Although pediatric emergency telemedicine confronts many of the same challenges of other telemedicine applications, reimbursement is relatively less significant, and workflow disruption are relatively more significant in this setting." **2)** "As of 2011, nearly all pediatric EDs with pediatric EM fellowship programs use emergency US. Pediatric EM fellowship programs provide emergency US training to their fellows, with a structured rotation being offered by most of these programs." **3)** "More effective adoption of pediatric emergency telemedicine among clinicians will require addressing perceived usefulness and perceived ease of use in the context of local factors. Future studies should examine the impact of specific identified strategies on adoption of pediatric emergency telemedicine and patient outcomes in rural settings."	**Search Terms:** Jeremy Kahn, Kahn, JM, pediatric. **Results:** 14 **Notes:** Only included studies published from 2012 and on with pediatric EMS components.

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Mental Health INNOVATION: Rapidly screen children who might not otherwise have access to mental health services by providing effective tools for ER based screening.	**1)** Grupp-Phelan, J., Mahajan, P., Foltin, G. L., Jacobs, E., Tunik, M., Sonnett, M., . . . Dayan, P. (2009). Referral and resource use patterns for psychiatric-related visits to pediatric emergency departments. *Pediatr Emerg Care, 25*(4), 217-220. **2)** Alisic, E., Hoysted, C., Kassam-Adams, N., Landolt, M. A., Curtis, S., Kharbanda, A. B., . . . Babl, F. E. (2016). Psychosocial Care for Injured Children: Worldwide Survey among Hospital Emergency Department Staff. J Pediatr, 170, 227-233 e221-226. doi: 10.1016/j.jpeds.2015.10.067	**1)** Patterns of referral and resource use for patients with psychiatric-related visits presenting to pediatric EDs **2)** ED staff's knowledge of traumatic stress in children, attitudes toward providing psychosocial care, and confidence in doing so	**1)** "The most common chief complaints were suicidality (47%), aggression/agitation (42%), and anxiety/depression (27%), alone or in combination…Children with psychiatric-related visits seem to require substantial ED resources. Interventions are needed to reduce the burden on the ED by increasing the linkage to mental health services, particularly for suicidal youths." **2)** "More education of ED staff regarding child traumatic stress and psychosocial care appears needed and would be welcomed. Universal education packages that are readily available can be modified for use in the ED." **3)** "To ensure that every child and adolescent presenting to an ER in psychiatric crisis receives the standard of care described below would	**Search Terms:** PECARN, Alpern ER [Author], Chun TH [Author], Kuppermann N [Author] **Results:** ~494 titles and abstracts reviewed, 211 pulled

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	3) Chun, T. H., Duffy, S. J., & Linakis, J. G. (2013). Emergency Department Screening for Adolescent Mental Health Disorders: The Who, What, When, Where, Why and How It Could and Should Be Done. Clin Pediatr Emerg Med, 14(1), 3-11. doi: 10.1016/j.cpem.2013.01.003 **4)** Mahajan, P., Alpern, E. R., Grupp-Phelan, J., Chamberlain, J., Dong, L., Holubkov, R., . . . Foltin, G. L. (2009). Epidemiology of psychiatric-related visits to emergency departments in a multicenter collaborative research pediatric network. Pediatr Emerg Care, 25(11), 715-720. doi: 10.1097/PEC.0b013e3181bec82f	**3)** Review for managing pediatric mental health crises in the ED **4)** Epidemiology of pediatric psychiatric-related visits to emergency departments participating in the PECARN	require a broad investment and collaboration between child and adolescent psychiatrist and pediatricians. Together the following must be advocated for: 1. Development of clear standards of care for emergency evaluation and treatment. 2. Increased training for emergency medical providers and pediatricians in identification and treatment of child mental illness, as well as in de-escalation and crisis management. 3. Greater collaboration between emergency providers and child psychiatrists for consultation around high-risk cases. 4. Greater availability and accessibility of high-quality inpatient and acute care outpatient services for youth in crisis. 5. Coordination of research and program-development efforts to identify and disseminate efficacious and cost-effective models of crisis care, both ER-based and community-based, for children and adolescents." **4)** "Pediatric psychiatric-related visits require more prehospital and emergency department resources and have higher admission/transfer rates than non-psychiatric-related visits within a large national pediatric emergency network."	
Opioid/Substance Abuse INNOVATION: Development of rapid screening tool to assess adolescents at risk for substance abuse in non traditional settings (ER).	**1)** Spirito, A., Bromberg, J. R., Casper, T. C., Chun, T. H., Mello, M. J., Dean, J. M., & Linakis, J. G. (2016). Reliability and Validity of a Two-Question Alcohol Screen in the Pediatric Emergency Department. Pediatrics, 138(6). doi: 10.1542/peds.2016-0691	**1)** Psychometric properties of the National Institute of Alcohol Abuse and Alcoholism (NIAAA) screen within pediatric EDs	**1)** "The NIAAA 2-question screen is a brief, valid approach for alcohol screening in PEDs. A positive screen suggests that referral for further evaluation is indicated to determine if an adolescent has an AUD."	
Disaster Preparedness	AAP Pediatric Preparedness Resource Kit			
Trauma INNOVATION: Ionizing radiation such as that delivered with xrays and CT scans has been linked to childhood cancer deaths. PECARN has designed strategies and	**1)** Yen, K., Kuppermann, N., Lillis, K., Monroe, D., Borgialli, D., Kerrey, B. T., . . . Holmes, J. F. (2013). Interobserver agreement in the clinical assessment of children with blunt abdominal trauma. Acad Emerg Med, 20(5), 426-432. doi: 10.1111/acem.12132 **2)** Holmes, J. F., Lillis, K., Monroe, D., Borgialli, D., Kerrey, B. T., Mahajan, P., . . . Kuppermann, N. (2013). Identifying children at very low risk of clinically important blunt abdominal injuries. Ann Emerg Med, 62(2), 107-116 e102. doi: 10.1016/j.annemergmed.2012.11.009	**1)** Interobserver agreement of historical and physical examination findings in the evaluation of children with blunt abdominal trauma **2)** Risk for intra-abdominal injuries **3)** Variability of clinician-performed Focused Assessment with Sonography for Trauma	**1)** "Observers can achieve at least acceptable agreement on the majority of historical and physical examination variables in children with blunt abdominal trauma evaluated in the ED. Those variables are candidates for consideration for development of a clinical predication rule for intra-abdominal injury in children with blunt trauma." **2)** "A prediction rule consisting of 7 patient history and physical examination findings, and without laboratory or ultrasonographic information, identifies children with blunt torso trauma who are at very low risk for intra-abdominal injury undergoing acute intervention. These findings require external validation before implementation." **3)** "The FAST examination is used in a relatively small percentage of children with BTT. Use increases as clinical suspicion for IAI increase.	

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screening tools to define which children who have sustained trauma would benefit most from diagnostic tests.	**3)** Menaker, J., Blumberg, S., Wisner, D. H., Dayan, P. S., Tunik, M., Garcia, M., . . . Holmes, J. F. (2014). Use of the focused assessment with sonography for trauma (FAST) examination and its impact on abdominal computed tomography use in hemodynamically stable children with blunt torso trauma. J Trauma Acute Care Surg, 77(3), 427-432. doi: 10.1097/ta.0000000000000296 **4)** Lee, L. K., Rogers, A. J., Ehrlich, P. F., Kwok, M., Sokolove, P. E., Blumberg, S., . . . Holmes, J. F. (2014). Occult pneumothoraces in children with blunt torso trauma. Acad Emerg Med, 21(4), 440-448. doi: 10.1111/acem.12344 **5)** Mahajan, P., Kuppermann, N., Tunik, M., Yen, K., Atabaki, S. M., Lee, L. K., . . . Holmes, J. F. (2015). Comparison of Clinician Suspicion Versus a Clinical Prediction Rule in Identifying Children at Risk for Intra-abdominal Injuries After Blunt Torso Trauma. Acad Emerg Med, 22(9), 1034-1041. doi: 10.1111/acem.12739 **6)** Ellison, A. M., Quayle, K. S., Bonsu, B., Garcia, M., Blumberg, S., Rogers, A., . . . Holmes, J. F. (2015). Use of Oral Contrast for Abdominal Computed Tomography in Children With Blunt Torso Trauma. Ann Emerg Med, 66(2), 107-114 e104. doi: 10.1016/j.annemergmed.2015.01.014 **7)** Adelgais, K. M., Kuppermann, N., Kooistra, J., Garcia, M., Monroe, D. J., Mahajan, P., . . . Holmes, J. F. (2014). Accuracy of the abdominal examination for identifying children with blunt intra-abdominal injuries. J Pediatr, 165(6), 1230-1235 e1235. doi: 10.1016/j.jpeds.2014.08.014 **8)** Borgialli, D. A., Ellison, A. M., Ehrlich, P., Bonsu, B., Menaker, J., Wisner, D. H., . . . Holmes, J. F. (2014). Association between the seat belt sign and intra-abdominal injuries in children with blunt torso trauma in motor vehicle collisions. Acad Emerg Med, 21(11), 1240-1248. doi: 10.1111/acem.12506 **9)** Wisner, D. H., Kuppermann, N., Cooper, A., Menaker, J., Ehrlich, P., Kooistra, J., . . . Holmes, J. F. (2015). Management of children with solid organ injuries after blunt torso trauma. J Trauma Acute Care	(FAST) examinations and its impact on abdominal computed tomography (AbCT) **4)** Proportion of occult pneumothraces in injured children and the rate of treatment with tube thoracostomy **5)** Comparison of clinician suspicion vs a clinical prediction rule in identifying children at risk for intra-abdominal injuries **6)** Test characteristics of abdominal CT for identifying intra-abdominal injuries **7)** Accuracy of complaints of abdominal pain and findings of abdominal tenderness for identifying intra-abdominal injury (IAI) in children with blunt intra-abdominal injuries **8)** Association between the abdominal seat belt sign and intra-abdominal injuries (IAIs) in children with blunt torso trauma after motor vehicle collisions (MVCs) **9)** Current management of children with intra-abdominal solid organ injuries after blunt trauma **10)** Prevalence of intra-abdominal injury diagnosis after a normal abdominal CT	Patients with a low or moderate clinician suspicion of IAI are less likely to undergo AbCT if they receive a FAST examination." **4)** "Pneumothoraces occur in approximately 5% of children with blunt torso trauma, and most are not identified on initial chest radiography. Children with occult pneumothoraces are less likely to receive tube thoracstomies compared to those with nonoccult pneumothoracies." **5)** "A clinical prediction rule had a significantly higher sensitivity than clinician suspicion for identifying intra-abdominal injury undergoing acute intervention, but a lower specificity. The higher specificity of clinician suspicion, however, did not translate into clinical practice, as clinicians frequently obtained abdominal computed tomography scans in patients they considered to be at very low risk." **6)** "Oral contrast is still used in a substantial portion of children undergoing abdominal CT after blunt torso trauma. With the exception of a slightly better specificity, test characteristics for detecting intra-abdominal injury were similar between CT with and without oral contrast." **7)** "The sensitivity of abdominal findings for IAI decreases as GCS score decreases. Although abdominal computed tomography is not mandatory, the risk of IAI is sufficiently high that diagnostic evaluation is warranted in children with isolated abdominal pain or tenderness." **8)** "Pediatric patients with seat belt signs after motor vehicle crashes are at a greater risk of intra-abdominal injuries than those without seat belt signs, primarily due to a greater risk of gastrointestinal injuries. In addition, these patients are also more likely to undergo acute interventions than those without seat belt signs. " **9)** "Most children with solid organ injuries are managed with observation. Blood transfusion, while uncommon, is the most frequent therapeutic intervention; angiographic embolization and laparotomy are uncommon. Emergency department disposition of children with isolated Grade I to II solid organ injuries is highly variable and often differs from published guidelines." **10)** "In a multicenter study of children evaluated in EDs after blunt torso trauma, intra-abdominal injuries were rarely diagnosed after a normal abdominal CT scan result, suggesting that safe discharge is possible for the children when there are no other reasons for admission." **11)** "Plain anteroposterior pelvic radiographs have a limited sensitivity for identifying children with pelvic fractures or dislocations after blunt trauma, including patients undergoing operative intervention and those with hypotension." **12)** "After blunt torso trauma, pediatric patients identified by the treating physicians as black non-Hispanic were less likely to receive abdominal CT imaging than those identified as white non-Hispanic. This suggests that	

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	Surg, 79(2), 206-214;quiz 332. doi: 10.1097/ta.0000000000000731 **10)** Kerrey, B. T., Rogers, A. J., Lee, L. K., Adelgais, K., Tunik, M., Blumberg, S. M., . . . Holmes, J. F. (2013). A multicenter study of the risk of intra-abdominal injury in children after normal abdominal computed tomography scan results in the emergency department. Ann Emerg Med, 62(4), 319-326. doi: 10.1016/j.annemergmed.2013.04.006 **11)** Kwok, M. Y., Yen, K., Atabaki, S., Adelgais, K., Garcia, M., Quayle, K., . . . Holmes, J. F. (2015). Sensitivity of plain pelvis radiography in children with blunt torso trauma. Ann Emerg Med, 65(1), 63-71 e61. doi: 10.1016/j.annemergmed.2014.06.017 **12)** Natale, J. E., Joseph, J. G., Rogers, A. J., Tunik, M., Monroe, D., Kerrey, B., . . . Holmes, J. F. (2016). Relationship of Physician-identified Patient Race and Ethnicity to Use of Computed Tomography in Pediatric Blunt Torso Trauma. Acad Emerg Med, 23(5), 584-590. doi: 10.1111/acem.12943	**11)** Sensitivity of anteroposterior pelvic radiographs for identifying children with pelvic fractures **12)** Effect of race or ethnicity on receiving abdominal CT after blunt torso trauma	nonclinical factors influence clinician decision-making regarding use of abdominal CT in children."	
Cardiac Arrest INNOVATION: Cooling the brain has been shown to decrease neurological damage in certain babies but its use in older children was unclear. Current research now determines that it does not improve mortality.	**1)** Moler, F. W., Hutchison, J. S., Nadkarni, V. M., Silverstein, F. S., Meert, K. L., Holubkov, R., . . . Dean, J. M. (2016). Targeted Temperature Management After Pediatric Cardiac Arrest Due To Drowning: Outcomes and Complications. *Pediatr Crit Care Med, 17*(8), 712-720. doi: 10.1097/pcc.0000000000000763 **2)** Slomine, B. S., Silverstein, F. S., Christensen, J. R., Holubkov, R., Page, K., Dean, J. M., & Moler, F. W. (2016). Neurobehavioral Outcomes in Children After Out-of-Hospital Cardiac Arrest. *Pediatrics, 137*(4). doi: 10.1542/peds.2015-3412 **3)** Meert, K. L., Slomine, B. S., Christensen, J. R., Telford, R., Holubkov, R., Dean, J. M., & Moler, F. W. (2016). Family Burden After Out-of-Hospital Cardiac Arrest in Children. *Pediatr Crit Care Med, 17*(6), 498-507. doi: **4)** Browning, B., Page, K. E., Kuhn, R. L., DiLiberto, M. A., Deschenes, J., Taillie, E., . . . Pemberton, V. L. (2016). Nurses' Attitudes Toward Clinical Research: Experience of the Therapeutic Hypothermia After Pediatric Cardiac Arrest Trials. *Pediatr Crit Care Med, 17*(3), e121-129. doi: 10.1097/pcc.0000000000000609	**1)** Outcomes and complications in the drowning subgroup **2)** Neurobehavioral outcomes in children who survived out-of-hospital cardiac arrest **3)** Family burden among caregivers **4)** Nurses' attitudes towards therapeutic hypothermia after pediatric cardiac arrest (THAPCA) **5)** Association of systolic hypotension post-resuscitation **6)** Association of lactate levels post-resuscitation **7)** Oxygenation and ventilation status early after cardiac arrest	**1)** "In comatose survivors of out-of-hospital pediatric cardiac arrest due to drowning, hypothermia did not result in a statistically significant benefit in survival with good functional outcome or mortality at 1 year, as compared with normothermia." **2)** "Results revealed significant neurobehavioral morbidity across multiple functional domains, based both on caregiver reports and performance on objective cognitive measures, in survivors 1 year later. Older age was associated with worse outcomes, whereas cardiac arrest and family variables were not." **3)** "Families of children who survive OH-CA and have high risk for neurologic disability often experience substantial burden during the first year post-arrest. The extent of child dysfunction 3 months post-arrest is associated with family burden at 12 months." **4)** "The majority of nurses had positive perceptions of the THAPCA trials…Despite increased work, nurses remained enthusiastic demonstrating that studies with intensive bedside nursing procedures are feasible." **5)** "In the first six hours following successful resuscitation from pediatric cardiac arrest, systolic hypotension was documented in 56% and was associated with a higher rate of in-hospital mortality and worse hospital discharge neurologic outcomes." **6)** "Elevated lactate levels in the first 12 hours after successful resuscitation from pediatric cardiac arrest are associated with increased mortality."	

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	5) Topjian, A. A., French, B., Sutton, R. M., Conlon, T., Nadkarni, V. M., Moler, F. W., . . . Berg, R. A. (2014). Early postresuscitation hypotension is associated with increased mortality following pediatric cardiac arrest. *Crit Care Med, 42*(6), 1518-1523. doi: 10.1097/ccm.0000000000000216 **6)** Topjian, A. A., Clark, A. E., Casper, T. C., Berger, J. T., Schleien, C. L., Dean, J. M., & Moler, F. W. (2013). Early lactate elevations following resuscitation from pediatric cardiac arrest are associated with increased mortality*. Pediatr Crit Care Med, 14(8), e380-387. doi: 10.1097/PCC.0b013e3182976402 **7)** Bennett, K. S., Clark, A. E., Meert, K. L., Topjian, A. A., Schleien, C. L., Shaffner, D. H., . . . Moler, F. W. (2013). Early oxygenation and ventilation measurements after pediatric cardiac arrest: lack of association with outcome. Crit Care Med, 41(6), 1534-1542. doi: 10.1097/CCM.0b013e318287f54c **8)** Moler, F. W., Donaldson, A. E., Meert, K., Brilli, R. J., Nadkarni, V., Shaffner, D. H., . . . Dean, J. M. (2011). Multicenter cohort study of out-of-hospital pediatric cardiac arrest. Crit Care Med, 39(1), 141-149. doi: 10.1097/CCM.0b013e3181fa3c17 **9)** Moler, F. W., Meert, K., Donaldson, A. E., Nadkarni, V., Brilli, R. J., Dalton, H. J., . . . Dean, J. M. (2009). In-hospital versus out-of-hospital pediatric cardiac arrest: a multicenter cohort study. Crit Care Med, 37(7), 2259-2267. doi: 10.1097/CCM.0b013e3181a00a6a **10)** Meert, K. L., Donaldson, A., Nadkarni, V., Tieves, K. S., Schleien, C. L., Brilli, R. J., . . . Moler, F. W. (2009). Multicenter cohort study of in-hospital pediatric cardiac arrest. Pediatr Crit Care Med, 10(5), 544-553. doi: 10.1097/PCC.0b013e3181a7045c **11)** Moler, F. W., Silverstein, F. S., Holubkov, R., Slomine, B. S., Christensen, J. R., Nadkarni, V. M., . . . Dean, J. M. (2015). Therapeutic hypothermia after out-of-hospital cardiac arrest in children. N Engl J Med, 372(20), 1898-1908.	**8)** Factors associated with out-of-hospital cardiac arrest survival **9)** Cardiac arrest (CA) with return of circulation (ROC) in in-hospital (IH) and out-of-hospital (OH) setting **10)** Factors associated with hospital mortality in children who experienced in-hospital cardiac arrest with sustained ROC **11)** Effects of therapeutic hypothermia in pediatric out-of-hospital cardia arrests	**7)** "Although we did not demonstrate an association between hyperoxia and worse outcome, the small proportion of patients kept within normal ranges limited our power. Preclinical data suggesting potential harm with hyperoxia remain compelling, and further investigation, including prospective, large studies involving robust recording of physiological derangements, is necessary to further advance our understanding of this important topic." **8)** "Event characteristics associated with increased survival were the following: weekend arrests, CPR not ongoing at hospital arrival, arrest rhythm not asystole, no atropine or $NaHCO_3$, fewer epinephrine doses, shorter duration of CPR, and drowning or asphyxial arrest event. For the 0-12 hour post –arrest ROC period, absence of any vasopressor or inotropic agent (dopamine, epinephrine) use, higher lowest temperature recorded, greater lowest pH, lower lactate, lower maximum glucose and normal pupillary responses were all associated with survival." **9)** "During the 0-12h interval following ROC, OH cases had lower minimum temperature and pH, and higher maximum serum glucose recorded. Mortality was greater in the OH cohort (62% vs.51%, p=0.04) with the cause attributed to a neurological indication much more frequent in the OH than IH cohort (69% vs. 20%; p<0.01)." **10)** "After adjustment for age, gender and first documented cardiac arrest rhythm, variables available prior to and during the arrest that were independently associated with increased mortality included pre-existing hematologic, oncologic, or immunologic disorders, genetic or metabolic disorders, presence of an endotracheal tube prior to the arrest, and the use of sodium bicarbonate during the arrest. Variables associated with decreased mortality included post-operative CPR. Extending the time frame to include variables available prior to, during, and within 12 hours following arrest, variables independently associated with increased mortality included the use of calcium during the arrest. Variables associated with decreased mortality included higher minimum blood pH and pupillary responsiveness." **11)** "In comatose children who survived out-of-hospital cardiac arrest, therapeutic hypothermia, as compared with therapeutic normothermia, did not confer a significant benefit in survival with a good functional outcome at 1 year."	
Cervical Spine INNOVATION: Ionizing radiation	**1)** Olsen, C. S., Kuppermann, N., Jaffe, D. M., Brown, K., Babcock, L., Mahajan, P. V., & Leonard, J. C. (2015). Interobserver agreement in retrospective chart reviews for factors associated with cervical spine	**1)** Interobserver agreement in cervical spine injuries (CSI)	**1)** "Most retrospectively assessed variables thought to be predictive of CSIs in blunt trauma-injured children had at least moderate interobserver agreement, suggesting that these data are sufficiently valid for use in identifying potential predictors of CSI."	

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such as that delivered with xrays and CT scans has been linked to childhood cancer deaths. PECARN has designed strategies and screening tools to define which children who have sustained potential neck trauma would benefit most from diagnostic tests.	injuries in children. Acad Emerg Med, 22(4), 487-491. doi: 10.1111/acem.12630 **2)** Anders, J. F., Adelgais, K., Hoyle, J. D., Jr., Olsen, C., Jaffe, D. M., & Leonard, J. C. (2014). Comparison of outcomes for children with cervical spine injury based on destination hospital from scene of injury. Acad Emerg Med, 21(1), 55-64. doi: 10.1111/acem.12288 **3)** Nigrovic, L. E., Rogers, A. J., Adelgais, K. M., Olsen, C. S., Leonard, J. R., Jaffe, D. M., & Leonard, J. C. (2012). Utility of plain radiographs in detecting traumatic injuries of the cervical spine in children. Pediatr Emerg Care, 28(5), 426-432. doi: 10.1097/PEC.0b013e3182531911 **4)** Leonard, J. C., Kuppermann, N., Olsen, C., Babcock-Cimpello, L., Brown, K., Mahajan, P., . . . Jaffe, D. M. (2011). Factors associated with cervical spine injury in children after blunt trauma. Ann Emerg Med, 58(2), 145-155. doi: 10.1016/j.annemergmed.2010.08.038 **5)** Leonard, J. R., Jaffe, D. M., Kuppermann, N., Olsen, C. S., & Leonard, J. C. (2014). Cervical spine injury patterns in children. Pediatrics, 133(5), e1179-1188. doi: 10.1542/peds.2013-3505 **6)** Leonard, J. C., Jaffe, D. M., Olsen, C. S., & Kuppermann, N. (2015). Age-related differences in factors associated with cervical spine injuries in children. Acad Emerg Med, 22(4), 441-446. doi: 10.1111/acem.12637 **7)** Kim, E. G., Brown, K. M., Leonard, J. C., Jaffe, D. M., Olsen, C. S., & Kuppermann, N. (2013). Variability of prehospital spinal immobilization in children at risk for cervical spine injury. Pediatr Emerg Care, 29(4), 413-418. doi: 10.1097/PEC.0b013e318289d743 **8)** Babcock, L., Olsen, C. S., Jaffe, D. M., & Leonard, J. C. (2016). Cervical Spine Injuries in Children Associated With Sports and Recreational Activities. Pediatr Emerg Care. doi: 10.1097/pec.0000000000000819 **9)** Mahajan, P., Jaffe, D. M., Olsen, C. S., Leonard, J. R., Nigrovic, L. E., Rogers, A. J., . . . Leonard, J. C. (2013). Spinal cord injury without radiologic abnormality in children imaged with magnetic resonance imaging. J Trauma Acute Care Surg, 75(5), 843-847. doi: 10.1097/TA.0b013e3182a74abd	**2)** Transport time and secondary transfer effects on CSI **3)** Sensitivity of plain radiographs in identifying bony or ligamentous CSI in children **4)** Risk factors associated with CSI in children after blunt trauma **5)** Description of CSIs in a large cohort of children **6)** CSI risk factors in age subgroups within the PECARN study cohort **7)** Prehospital spinal immobilization techniques after blunt trauma **8)** Factors associated with CSI in children injured during sports and recreational activities **9)** Comparison of children diagnosed with cervical spinal cord injury without radiographic abnormality (SCIWORA) relative to evidence of cervical spinal cord abnormalities on MRI	**2)** "Initial destination from scene (pediatric trauma center vs. local hospital) appears to be associated with neurologic outcome of children with cervical spine injuries. Markers of injury severity (altered mental status and focal neurologic findings) are important predictors of poor outcome in children with cervical spine injuries and should remain the primary guide for prehospital triage to designated trauma centers." **3)** "Plain radiographs had a high sensitivity for cervical spine injury in our pediatric cohort…Although advanced imaging likely provides a higher sensitivity for cervical spine injury, it often comes with increased costs and significantly higher radiation exposure. Further prospective study is needed to determine exactly which children after blunt cervical spine trauma will benefit from advanced imaging." **4)** "In this large, multicenter case-control analysis, we identified 8 factors associated with cervical spine injury in children who experienced blunt trauma (altered mental status, focal neurologic deficits, complaint of neck pain, torticollis, substantial injury to the torso, predisposing condition, high-risk motor vehicle crash, and diving). These historical and physical examination findings are highly predictive of cervical spine injury in children after trauma and differ somewhat from previously established adult screening criteria and those from smaller pediatric studies." **5)** "We demonstrated a high degree of variability of CSI patterns, treatments and outcomes in children. The rarity, variation, and morbidity of pediatric CSIs make prompt recognition and treatment critical…Future prospective investigations are needed to develop evidence-based protocols for evaluation and treatment of children with these potentially devastating injuries." **6)** "While this analysis supports the original PECARN model for CSI, there were subtle age variations in factors associated with CSIs in children that warrant future investigation." **7)** "In this retrospective, observational study involving several emergency departments and Emergency Medical Services systems, we found that full spinal immobilization is inconsistently applied to children younger than 2 years after blunt trauma regardless of the presence of CSI. Full spinal immobilization is applied more consistently to older children with CSI." **8)** "In children injured during sports and recreational activities, focal neurologic findings, neck pain, axial loading impacts, and the possibility of spinal cord injury without radiographic abnormality should guide the diagnostic evaluation for potential cervical spine injuries. Certain activities have a considerable frequency of cervical spine injury, which may benefit from activity-specific preventative measures."	

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Topic	**References**	**Outcomes**	**Summary**	**Notes**
			9) "Children diagnosed with SCIWORA but with normal MRI finding in our cohort presented differently and had substantially more favorable clinical outcomes than those with cervical cord abnormalities on MRI."	
Seizures INNOVATION: Seizures are a common reason that parents seek emergency care for children. Many drugs are used to stop seizures. PECARN has identified the effectiveness of specific drugs for stopping seizure applicable to both the ED and prehospital settings.	**1)** Dayan, P. S., Lillis, K., Bennett, J., Conners, G., Bailey, P., Callahan, J., . . . Kuppermann, N. (2011). Interobserver agreement in the assessment of clinical findings in children with first unprovoked seizures. Pediatrics, 127(5), e1266-1271. doi: 10.1542/peds.2010-1752 **2)** Chamberlain, J. M., Okada, P., Holsti, M., Mahajan, P., Brown, K. M., Vance, C., . . . Baren, J. (2014). Lorazepam vs diazepam for pediatric status epilepticus: a randomized clinical trial. JAMA, 311(16), 1652-1660. doi: 10.1001/jama.2014.2625 **3)** Chamberlain, J. M., Capparelli, E. V., Brown, K. M., Vance, C. W., Lillis, K., Mahajan, P., . . . van den Anker, J. N. (2012). Pharmacokinetics of intravenous lorazepam in pediatric patients with and without status epilepticus. J Pediatr, 160(4), 667-672 e662. doi: 10.1016/j.jpeds.2011.09.048	**1)** Interobserver agreement of patient history and physical examination variables used to assess children undergoing ED evaluation for a first seizure not provoked by a known precipitant **2)** Efficacy of lorazepam vs diazepam for treating pediatric status epilepticus **3)** Single dose pharmacokinetics of an IV dose of lorazepam in pedi patients treated for status epilepticus (SE) or with a history of SE.	**1)** "For children with first unprovoked seizures evaluated in the ED, clinicians frequently assess findings from seizure-specific history with substantial agreement beyond chance. Those clinical variable that have been associated with the presence of intracranial abnormalities and show reliability between assessors, such as seizure focality and the presence of any focal neurological finding, may be more useful in the ED assessment of children with first unprovoked seizures." **2)** "Among pediatric patients with convulsive status epilepticus, treatment with lorazepam did not result in improved efficacy or safety compared with diazepam. These findings do not support the preferential use of lorazepam for this condition." **3)** "Lorazepam pharmacokinetics in convulsive SE is similar to earlier pharmacokinetics measured in pediatric patients with cancer, except for longer half-life, and similar to adult pharmacokinetics parameters except for increased clearance."	
Quality and Safety INNOVATION: Patient safety in EDs is at risk because of the chaotic environment, unique characteristics of children, and the need to involve multiple family members in the care management plans. PECARN has identified strategies to help make ER's safer for children in order	**1)** Shaw, K. N., Ruddy, R. M., Olsen, C. S., Lillis, K. A., Mahajan, P. V., Dean, J. M., & Chamberlain, J. M. (2009). Pediatric patient safety in emergency departments: unit characteristics and staff perceptions. Pediatrics, 124(2), 485-493. doi: 10.1542/peds.2008-2858 **2)** Shaw, K. N., Lillis, K. A., Ruddy, R. M., Mahajan, P. V., Lichenstein, R., Olsen, C. S., & Chamberlain, J. M. (2013). Reported medication events in a paediatric emergency research network: sharing to improve patient safety. Emerg Med J, 30(10), 815-819. doi: 10.1136/emermed-2012-201642 **3)** Chamberlain, J. M., Shaw, K. N., Lillis, K. A., Mahajan, P. V., Ruddy, R. M., Lichenstein, R., . . . Dean, J. M. (2013). Creating an infrastructure for safety event reporting and analysis in a multicenter pediatric emergency department network. Pediatr Emerg Care, 29(2), 125-130. doi: 10.1097/PEC.0b013e31828043a5 **4)** Lichenstein, R., O'Connell, K., Funai, T., Blumberg, S., Shaw, K., Ruddy, R., . . . Chamberlain, J. M. (2016).	**1)** Characteristics, staff perceptions, and associations related to patient safety **2)** Medication errors **3)** Establishment of a safety event reporting system **4)** Types and severity of reported lab errors in pedi EDs **5)** Differences in the quality of emergency care for children related to differences in hospital setting, physician training, and demographic factors **6)** Pediatric emergency department near-miss events and unsafe	**1)** "Large variability existed among EDs in structures and processes through to be associated with patient safety and in staff perception of the safety climate. Several ED characteristics were associated with a positive climate of safety." **2)** "ME reporting by the system revealed valuable data across sites on medication categories and potential human factors. Harm was infrequently reported. Our analyses identify trends and latent systems issues, suggesting areas for future interventions to reduce paediatric ED medication errors." **3)** "Large variability in reporting rates and low rates of providing contributing factors suggest a need for standardization and improvement of safety event reporting…The most common reported events relate to errors in coordination between the ED and laboratory, medication errors, and process variance such as delays in care." **4)** "Most events are preanalytic and involve problems with specimens that are improperly collected, mislabeled, or lost. Although most events were not associated with harm, there is a potential for significant injury." **5)** "Our findings of differences in quality of care associated with hospital type and physician training reinforce the importance of addressing disparities in quality of emergency care between urban and rural hospitals caring for acutely ill and injured children."	

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to reduce errors and decrease mortality and morbidity.	Laboratory Errors in a Pediatric Emergency Department Network: An Analysis of Incident Reports. Pediatr Emerg Care, 32(10), 653-657. doi: 10.1097/pec.0000000000000414 **5)** Dharmar, M., Marcin, J. P., Romano, P. S., Andrada, E. R., Overly, F., Valente, J. H., . . . Kuppermann, N. (2008). Quality of care of children in the emergency department: association with hospital setting and physician training. J Pediatr, 153(6), 783-789. doi: 10.1016/j.jpeds.2008.05.025 **6)** Ruddy, R. M., Chamberlain, J. M., Mahajan, P. V., Funai, T., O'Connell, K. J., Blumberg, S., . . . Shaw, K. N. (2015). Near misses and unsafe conditions reported in a Pediatric Emergency Research Network. BMJ Open, 5(9), e007541. doi: 10.1136/bmjopen-2014-007541 **7)** Stanley, R., Lillis, K. A., Zuspan, S. J., Lichenstein, R., Ruddy, R. M., Gerardi, M. J., & Dean, J. M. (2010). Development and implementation of a performance measure tool in an academic pediatric research network. Contemp Clin Trials, 31(5), 429-437. doi: 10.1016/j.cct.2010.05.007 **8)** Blumberg, S. M., Mahajan, P. V., O'Connell, K. J., Chamberlain, J. M., Shaw, K. N., Ruddy, R. M., . . . Lillis, K. A. (2017). Radiologic Safety Events Within a Pediatric Emergency Medicine Network. Pediatr Emerg Care, 33(2), 92-96. doi: 10.1097/pec.0000000000000684 **9)** Bhatt, M., Kennedy, R. M., Osmond, M. H., Krauss, B., McAllister, J. D., Ansermino, J. M., . . . Roback, M. G. (2009). Consensus-based recommendations for standardizing terminology and reporting adverse events for emergency department procedural sedation and analgesia in children. Ann Emerg Med, 53(4), 426-435 e424. doi: 10.1016/j.annemergmed.2008.09.030 **10)** Alessandrini, E., Varadarajan, K., Alpern, E. R., Gorelick, M. H., Shaw, K., Ruddy, R. M., & Chamberlain, J. M. (2011). Emergency department quality: an analysis of existing pediatric measures. Acad Emerg Med, 18(5), 519-526. doi: 10.1111/j.1553-2712.2011.01057.x	conditions from hospital reporting systems **7)** Description of collaborative development of a site performance measure tool "report card" in an academic pediatric research network **8)** Epidemiology of radiologic safety events **9)** Consensus based recommendations for standardizing procedural sedation and analgesia terminology and reporting of adverse events **10)** Performance measures relevant to pediatric emergency care	**6)** "Medication and process-related issues are important causes of near miss and unsafe conditions in the network. Human factors issues were highly reported and non-compliance with established procedures was very common, and calculation issues, communications (ie, handoffs) and clinical judgement were also important." **7)** "Report cards have helped PECARN sites and investigators focus on performance improvement and may have contributed to improved operations and efficiencies within the network." **8)** "We described the epidemiology of radiology-related IRs from a large multicenter pediatric emergency research network. The study identified specific themes regarding types of radiologic errors, including the systems issues and the contributing factors associated with those errors. Results from this analysis may help identify effective intervention strategies to ameliorate the frequency of radiology-related safety events in the emergency department setting." **9)** "In this article, our consensus panel proposes a framework of definitions and recommendations for reporting sedation terminology, time intervals, and adverse events for procedural sedation research. It is our goal that through this standardization, future sedation studies will generate data that may be readily compared and aggregated." **10)** "A wide range of performance measures relevant to pediatric emergency care are available. However, measures lack a systematic and comprehensive approach to evaluate the quality of care provided."	

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DKA	**1**) Garro, A., Chodobski, A., Szmydynger-Chodobska, J., Shan, R., Bialo, S. R., Bennett, J., . . . Glaser, N. (2017). Circulating matrix metalloproteinases in children with diabetic ketoacidosis. Pediatr Diabetes, 18(2), 95-102. doi: 10.1111/pedi.12359 **2)** Glaser, N. S., Ghetti, S., Casper, T. C., Dean, J. M., & Kuppermann, N. (2013). Pediatric diabetic ketoacidosis, fluid therapy, and cerebral injury: the design of a factorial randomized controlled trial. Pediatr Diabetes, 14(6), 435-446. doi: 10.1111/pedi.12027	**1)** Circulating matric metalloproteinases (MMPs) in children with diabetic ketoacidosis vs type 1 diabetes **2)** Effects of rehydration rate and fluid sodium content on neurological status during DKA treatment and long-term neurocognitive outcomes	**1)** "Circulating MMP-2 levels are lower and MMP-9 levels are higher in children during DKA compared with levels in children with diabetes without DKA. Alterations in MMP expression could mediate BBB dysfunction occurring during DKA." **2)** "The Pediatric Emergency Care Applied Research Network FLUID (FLuid therapies Under Investigation in DKA) study is the first prospective randomized trial to evaluate fluid regimens for pediatric DKA."-This article outlines the design of the randomized controlled trial	
Bronchiolitis INNOVATION: Bronchiolitis is a common illness in infants. PECARN has identified strategies for determining who is at risk for needing more intensive care and what medications are appropriate.	**1)** Corneli, H. M., Zorc, J. J., Mahajan, P., Shaw, K. N., Holubkov, R., Reeves, S. D., . . . Kuppermann, N. (2007). A multicenter, randomized, controlled trial of dexamethasone for bronchiolitis. N Engl J Med, 357(4), 331-339. doi: 10.1056/NEJMoa071255 **2)** Corneli, H. M., Zorc, J. J., Holubkov, R., Bregstein, J. S., Brown, K. M., Mahajan, P., & Kuppermann, N. (2012). Bronchiolitis: clinical characteristics associated with hospitalization and length of stay. Pediatr Emerg Care, 28(2), 99-103. doi: 10.1097/PEC.0b013e3182440b9b	**1)** Effectiveness of oral corticosteroids in bronchiolitis **2)** Initial clinical characteristics of bronchiolitis associated with admission and longer LOS	**1)** "In infants with acute moderate-to-sever bronchiolitis who were treated in the emergency department, a single dose of 1 mg of oral dexamethasone per kilogram did not significantly alter the rate of hospital admission, the respiratory status after 4 hours of observation, or later outcomes." **2)** "A model using objective findings had limited accuracy for predicting hospitalization after emergency department evaluation for bronchiolitis. In these infants with moderate to severe bronchiolitis, however, initial SpO_2 was the best predictor of hospital admission and of longer LOS."	
Sickle Cell INNOVATION: Sickle cell anemia is a common reason children are exposed to opiates chronically. Identifying interventions that can decrease opiate use is important in minimizing the risk of long term addiction. PECARN	**1)** Badaki-Makun, O., Scott, J. P., Panepinto, J. A., Casper, T. C., Hillery, C. A., Dean, J. M., & Brousseau, D. C. (2014). Intravenous magnesium for pediatric sickle cell vaso-occlusive crisis: methodological issues of a randomized controlled trial. Pediatr Blood Cancer, 61(6), 1049-1054. doi: 10.1002/pbc.24925 **2)** Brousseau, D. C., Scott, J. P., Badaki-Makun, O., Darbari, D. S., Chumpitazi, C. E., Airewele, G. E., . . . Panepinto, J. A. (2015). A multicenter randomized controlled trial of intravenous magnesium for sickle cell pain crisis in children. Blood, 126(14), 1651-1657. doi: 10.1182/blood-2015-05-647107 **3)** Nimmer, M., Czachor, J., Turner, L., Thomas, B., Woodford, A. L., Carpenter, K., . . . Brousseau, D. C. (2016). The Benefits and Challenges of Preconsent in a Multisite, Pediatric Sickle Cell Intervention Trial.	**1)** Efficacy and safety of IV magnesium sulfate for the management of acute SCD VOC **2)** IV magnesium vs normal saline in addition to standard therapy for the treatment of pediatric sickle cell pain crisis **3)** Benefits and challenges of preconsent in a multisite, pediatric sickle cell intervention trial	**1)** "The MAGiC study will elucidate the mechanisms by which IV magnesium may decrease the duration of VOC and, subsequently, hospital LOS for children admitted for VOC." **2)** "The addition of intravenous magnesium did not shorten length of stay, reduce opioid use, or improve quality of life in children hospitalized for sickle cell pain crisis." **3)** "In this study, preconsent facilitated enrollment in the absence of an LAR, highlighted to families the collaboration between ED and hematology, and provided a comfortable, less stressful, setting in which to obtain consent."	

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has investigated these alternate strategies.	Pediatr Blood Cancer, 63(9), 1649-1652. doi: 10.1002/pbc.26013			
Other INNOVATION: Sepsis carries a high risk of mortality and morbidity. PECARN is identifying unique and cutting edge strategies to rapidly identify children with and without bacterial infection (distinguishing those more at risk for sepsis).	**1)** Timm, N. L., McAneney, C., Alpern, E., Macy, M., & Ruddy, R. (2012). Is pediatric emergency department utilization by pregnant adolescents on the rise? Pediatr Emerg Care, 28(4), 307-309. doi: 10.1097/PEC.0b013e31824d8a49 **2)** Holsti, M., Zemek, R., Baren, J., Stanley, R. M., Mahajan, P., Vance, C., . . . Chamberlain, J. M. (2015). Variation of community consultation and public disclosure for a pediatric multi-centered "Exception from Informed Consent" trial. Clin Trials, 12(1), 67-76. doi: 10.1177/1740774514555586 **3)** Mintegi, S., Azkunaga, B., Prego, J., Qureshi, N., Dalziel, S. R., Arana-Arri, E., . . . Kuppermann, N. (2017). International Epidemiological Differences in Acute Poisonings in Pediatric Emergency Departments. Pediatr Emerg Care. doi: 10.1097/pec.0000000000001031 **4)** Alpern, E. R., Clark, A. E., Alessandrini, E. A., Gorelick, M. H., Kittick, M., Stanley, R. M., . . . Chamberlain, J. M. (2014). Recurrent and high-frequency use of the emergency department by pediatric patients. Acad Emerg Med, 21(4), 365-373. doi: 10.1111/acem.12347 **5)** Zonfrillo, M. R., Macy, M. L., Cook, L. J., Funai, T., Stanley, R. M., Chamberlain, J. M., . . . Alpern, E. R. (2016). Anticipated resource utilization for injury versus non-injury pediatric visits to emergency departments. Inj Epidemiol, 3(1), 12. doi: 10.1186/s40621-016-0077-4 **6)** Alessandrini, E. A., Alpern, E. R., Chamberlain, J. M., Shea, J. A., & Gorelick, M. H. (2010). A new diagnosis grouping system for child emergency department visits. Acad Emerg Med, 17(2), 204-213. doi: 10.1111/j.1553-2712.2009.00635.x **7)** Mahajan, P., Kuppermann, N., Mejias, A., Suarez, N., Chaussabel, D., Casper, T. C., . . . Ramilo, O. (2016). Association of RNA Biosignatures With Bacterial Infections in Febrile Infants Aged 60 Days or Younger. JAMA, 316(8), 846-857. doi: 10.1001/jama.2016.9207	**1)** Pregnant adolescents' utilization of pedi EDs **2)** Variation of community consultation and public disclosure activities approved by IRBs and the effectiveness of this process **3)** International epidemiological differences in acute poisonings in children presenting to EDs **4)** Epidemiology of and risk factors for recurrent and high frequency use of the ED by children **5)** Resource utilization for pediatric injury-related ED visits **6)** ICD-based diagnosis grouping system (DGS) for child ED visits **7)** RNA biosignatures **8)** The creation of an EMSC research agenda specific to multicenter research **9)** Pediatric patients transported by the PECARN's affiliated EMS agencies and the process of submitting and aggregating data from diverse agencies **10)** Feasibility of conducting microarray-based RNA transcriptional profile analyses for the	**1)** "Pregnant adolescents make up a small (<1%) but growing proportion of overall visits to PEDs. Future direction should include an evaluation of the educational opportunities provided during pediatric residency and pediatric emergency medicine fellowship training…" **2)** "There is substantial variation in IRBs' interpretations of the federal regulations for community consultation and public disclosure. One of the goals of community consultation and public disclosure efforts for emergency research is to provide community members an opportunity to opt-out of EFIC research; however, rarely do patients or their legally authorized representatives report having learned about a study prior to enrollment." **3)** "There are substantial epidemiological difference in acute poisonings among children in different countries and regions of the globe. International best practices need to be identified for prevention of acute poisonings in childhood." **4)** "Risk factors for recurrent ED use by children include age, race and ethnicity, and insurance status. Although asthma plays an important role in recurrent ED use, acute illnesses account for the majority of recurrent ED visits." **5)** "While admission rates and LOS increase with increasing AIS and SCS severity, these two classification schemas do not reliably correlate. Similarly, ED visit metrics differ between injured and non-injured patients in similar SCS categories. Although AIS and SCS both have value, these differences should be considered when using these schemas in research and quality improvement." **6)** "The DGS offers a clinically sensible method for describing pediatric ED visits by grouping ICD-9 codes in a consensus-derived classification scheme. This system may be used for research, reporting, needs assessment, and resource planning." **7)** "In this preliminary study, RNA biosignatures were defined to distinguish febrile infants aged 60 days or younger with and without bacterial infections. Further research with larger populations is needed to refine and validate the estimates of test accuracy and to assess the clinical utility of RNA biosignatures in practice." **8)** "The PECARN prioritization process identified high-priority EMSC research topics specific to multicenter research. PECARN has the capacity to answer long-standing important clinical controversies in EMSC, largely due to its ability to conduct randomized controlled trials and observational studies on a large scale."	

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	8) Miller, S. Z., Rincon, H., & Kuppermann, N. (2008). Revisiting the emergency medicine services for children research agenda: priorities for multicenter research in pediatric emergency care. Acad Emerg Med, 15(4), 377-383. doi: 10.1111/j.1553-2712.2008.00072.x **9)** Lerner, E. B., Dayan, P. S., Brown, K., Fuchs, S., Leonard, J., Borgialli, D., . . . Foltin, G. (2014). Characteristics of the pediatric patients treated by the Pediatric Emergency Care Applied Research Network's affiliated EMS agencies. Prehosp Emerg Care, 18(1), 52-59. doi: 10.3109/10903127.2013.836262 **10)** Mahajan, P., Kuppermann, N., Suarez, N., Mejias, A., Casper, C., Dean, J. M., & Ramilo, O. (2015). RNA transcriptional biosignature analysis for identifying febrile infants with serious bacterial infections in the emergency department: a feasibility study. Pediatr Emerg Care, 31(1), 1-5. doi: 10.1097/pec.0000000000000324 **11)** Leonard, J. C., Scharff, D. P., Koors, V., Lerner, E. B., Adelgais, K. M., Anders, J., . . . Jaffe, D. M. (2012). A qualitative assessment of factors that influence emergency medical services partnerships in prehospital research. Acad Emerg Med, 19(2), 161-173. doi: 10.1111/j.1553-2712.2011.01283.x **12)** Gorelick, M. H., Alpern, E. R., Singh, T., Snowdon, D., Holubkov, R., Dean, J. M., & Kuppermann, N. (2005). Availability of pediatric emergency visit data from existing data sources. Acad Emerg Med, 12(12), 1195-1200. doi: 10.1197/j.aem.2005.06.028 **13)** Foltin, G. L., Dayan, P., Tunik, M., Marr, M., Leonard, J., Brown, K., . . . Lerner, E. B. (2010). Priorities for pediatric prehospital research. Pediatr Emerg Care, 26(10), 773-777. doi: 10.1097/PEC.0b013e3181fc4088 **14)** Garcia, M., Taylor, G., Babcock, L., Dillman, J. R., Iqbal, V., Quijano, C. V., . . . Dayan, P. S. (2013). Computed tomography with intravenous contrast alone: the role of intra-abdominal fat on the ability to visualize the normal appendix in children. Acad Emerg Med, 20(8), 795-800. doi: 10.1111/acem.12185	diagnosis of serious bacterial infections in febrile infants 60 days and younger **11)** Barriers and motivators to participating in research at the agency and provider levels **12)** Availability and completeness of selected data elements from administrative and clinical sources for ED visits in a national pediatric research network **13)** Pediatric-specific prehospital research agenda **14)** Ability of radiologists to visualize the normal appendix with CT IV in children **15)** Relationship between ancillary testing for patients with asthma and patient, physician and hospital characteristics **16)** Trends in injury severity, and associations between injury-related ED visit outcome and patient and community-level sociodemographic characteristics **17)** Agreement on final diagnoses between electronic administrative sources and manually abstracted medical records	**9)** "Despite advances in data definitions and increased use of electronic databases nationally, data aggregation across EMS agencies was challenging, in part due to variable data collection methods and missing data. In our sample, only a small proportion of pediatric EMS patients required prehospital medications or interventions." **10)** "It is possible to create a robust infrastructure to conduct genomic studies in young febrile infants in the context of a multicenter pediatric ED research setting. The sufficient quantity and high quality of RNA obtained suggests that whole blood transcriptional profile analysis for the diagnostic evaluation of young febrile infants can be successfully performed in this setting." **11)** "This study describes factors that are deemed by EMS prehospital personnel to be important to their successful participation in research. We identified a comprehensive set of factors that address individual provider beliefs and knowledge and agency and professional norms and policies." **12)** "Data elements important in emergency medical care for children are frequently missing in existing administrative and medical record sources; completeness varies widely across EDs. Researches must be aware of these limitations in the use of existing data when planning studies." **13)** "PECARN has identified high-priority EMS research topics for children using a consensus-derived method. These research priorities include novel EMS system topics. The PECARN EMS pediatric research priority list will help focus future pediatric prehospital research both within and outside the network." **14)** "Our data demonstrate a strong relationship between intra-abdominal fat and patient weight and age. Protocols using computed tomography with intravenous contrast alone to visualize the appendix can reasonably include weight and/or age as considerations for determining when this approach is appropriate." **15)** "Ancillary testing occurred in more than one third of children with asthma, with chest radiographs ordered most frequently. Efforts to reduce the use of chest radiographs should target the management of febrile patients with asthma, whereas efforts to reduce blood testing should target providers without subspeciality training in pediatric emergency medicine and patients treated in nonchildren's hospitals who are more ill." **16)** "Pediatric injury-related ED visits to included sites increased over the study period while injury severity, anticipated resource utilization, and visit outcomes remained stable, with low rates of admission or transfer. Sociodemographic differences in injury-related visists and ED disposition were apparent. ED-based injury surveillance is essential to understand disparities, inform targets for prevention programs, and reduce the overall burden of childhood injuries."	

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Topic	**References**	**Outcomes**	**Summary**	**Notes**
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EMSC Impact and Outcomes References

Closed Head Injuries				
Topic	**References**	**Outcomes**	**Summary**	**Notes**
Development of PECARN Pediatric Head Injury/Trauma Algorithm for determining the necessity for CT injury in pediatric closed head injuries	**1)** Kuppermann, N., Holmes, J. F., Dayan, P. S., Hoyle, J. D., Jr., Atabaki, S. M., Holubkov, R., . . . Wootton-Gorges, S. L. (2009). Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. *Lancet, 374*(9696), 1160-1170. doi: 10.1016/s0140-6736(09)61558-0	Derivation and validation of prediction rules for clinically important traumatic brain injuries (ciTBI) to identify children at very low risk of ciTBI after blunt head trauma for whom CT might be unnecessary.	"In the validation population, the prediction rule for children younger than 2 years (normal mental status, no scalp hematoma except frontal, no loss of consciousness or loss of consciousness for less than 5 seconds, non-severe injury mechanism, no palpable skull fracture, and acting normally according to the parents) had a negative predictive value for ciTBI of 100% (95% CI 99.7% to 100.0%, n=1175/1175) and sensitivity of 100% (95% CI 86.3% to 100.0%, n=25/25)." "The prediction rule for children aged 2 years and older (normal mental status, no loss of consciousness, no vomiting, non-severe injury mechanism, no signs of basilar skull fracture, and no severe headache) had a negative predictive value of 99.95% (95% CI 99.80- to 99.99, n=3696/3698) and sensitivity of 96.8% (95% CI 89.0% to 99.6%, n=61/63)" "Neither rule missed neurosurgery in validation populations."	**Search Terms:** Closed Head Injury, Imaging, CT, Computed Tomography, PECARN, Validity **Results:** ~408
Validation of the PECARN Pediatric Head Injury/Trauma Algorithm INNOVATION: Ionizing radiation such as that delivered with CT scans has been linked to childhood cancer deaths. PECARN has designed and tested strategies to define which children who have sustained head trauma would benefit most from diagnostic tests and minimizing the need for tests that	**1)** Babl, F. E., Borland, M. L., Phillips, N., Kochar, A., Dalton, S., McCaskill, M., . . . Dalziel, S. R. (2017). Accuracy of PECARN, CATCH, and CHALICE head injury decision rules in children: a prospective cohort study. *Lancet*. doi: 10.1016/s0140-6736(17)30555-x **2)** Easter, J. S., Bakes, K., Dhaliwal, J., Miller, M., Caruso, E., & Haukoos, J. S. (2014). Comparison of PECARN, CATCH, and CHALICE rules for children with minor head injury: a prospective cohort study. *Ann Emerg Med, 64*(2), 145-152, 152 e141-145. doi: 10.1016/j.annemergmed.2014.01.030 **3)** Lorton, F., Poullaouec, C., Legallais, E., Simon-Pimmel, J., Chene, M. A., Leroy, H., . . . Gras-Le Guen, C. (2016). Validation of the PECARN clinical decision rule for children with minor head trauma: a French multicenter prospective study. *Scand J Trauma Resusc Emerg Med, 24*, 98. doi: 10.1186/s13049-016-0287-3 **4)** Schonfeld, D., Bressan, S., Da Dalt, L., Henien, M. N., Winnett, J. A., & Nigrovic, L. E. (2014). Pediatric Emergency Care Applied Research Network head injury clinical prediction rules are reliable in practice. *Arch Dis Child, 99*(5), 427-431. doi: 10.1136/archdischild-2013-305004	**1)** Diagnostic accuracy when applied outside the derivation setting **2)** Diagnostic accuracy **3)** Diagnostic performance and external validation **4)** Validation of the PECARN algorithm **5)** Diagnostic performance **6)** Quality improvement	**1)** " The highest point validation sensitivities were shown for PECARN in children younger than 2 years 100.0% (95% CI 90.7% to 100.0%; n=38/38) and PECARN in children 2 years and older 99.0% (95% CI 94.4% to 100.0%; n=97/98)….Positive predictive value in children younger than 2 years 2.0% (95% CI 1.4% to 2.8%), in children 2 years and older 1.6% (95% CI 1.3% to 1.9%)…Negative predictive value in children younger than 2 years 100.0% (95% CI 99.8% to 100.0%), in children 2 years and older 100.0% (95% CI 99.9% to 100.0%)…Negative predictive values in both analyses were higher than 99% for all rules." **2) "** PECARN accurately classified all patients with clinically important TBI. -In terms of identification of injuries requiring neurosurgical intervention, PECARN was the only rule to identify all of the injuries." **3) "**-No patient with ciTBI was misclassified in the very low-risk group, 2 were classified in the intermediate-risk group, and 7 in the high-risk group…In this study, the sensitivity of the PECARN clinical decision rule was 100% (95% CI 66.4% to 100%)…The specificity was 69.9% (95% CI 67.5% to 72.2%)…The negative predictive value was 100% (95% CI 99.7% to 100%)…The positive likelihood ratio was 3.3 (95% CI 3.1 to 3.6) and the negative likelihood ratio was 0 (95% CI 0 to 1.1)." **4)** "None of the children with a clinically important TBI were classified as very low risk… In the 372 children whom the PECARN TBI rules could be applied who also had a CT performed, the ability of these rules to identify children with a positive CT are as follows: sensitivity 97.1% (95% CI 90.0% to 99.2%), specificity 10.5% (95% CI 7.6% to 14.5%) and negative predictive value 94.1% (95% CI 80.9% to 98.4%)" **5)** "The PECARN CDR accurately detected all of the 6 patients with positive CT findings… PECARN sensitivity 100% (95% CI 54.1-100)…PECARN specificity: PECARN high and intermediate risk 61.6% (95% CI 58.8-64.4) and PECARN high risk only 96.7 (95% CI 95.5-97.6)." **6)** "Implementation of EHR-integrated decision support for children with head trauma presenting to the ED is associated with a decrease in CT utilization and no increase in significant safety events."	

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produce ionizing radiation.	**5)** Thiam, D. W., Yap, S. H., & Chong, S. L. (2015). Clinical Decision Rules for Paediatric Minor Head Injury: Are CT Scans a Necessary Evil? *Ann Acad Med Singapore, 44*(9), 335-341. **6)** Atabaki SM, Jacobs BR, MD, Brown KM, Shahzeidi S, Heard-Garris NJ, Chamberlain MB, Grell RM, Chamberlain JM. Quality Improvement in Pediatric Head Trauma with PECARN Rules Implementation as Computerized Decision Support. Pediatr Qual Safety 2017. doi: 10.1097/pq9.0000000000000019.			
PECARN Article	**1)** Powell, E. C., Atabaki, S. M., Wootton-Gorges, S., Wisner, D., Mahajan, P., Glass, T., . . . Kuppermann, N. (2015). Isolated linear skull fractures in children with blunt head trauma. *Pediatrics, 135*(4), e851-857. doi: 10.1542/peds.2014-2858 **2)** Borgialli, D. A., Mahajan, P., Hoyle, J. D., Jr., Powell, E. C., Nadel, F. M., Tunik, M. G., . . . Kuppermann, N. (2016). Performance of the Pediatric Glasgow Coma Scale Score in the Evaluation of Children With Blunt Head Trauma. Acad Emerg Med, 23(8), 878-884. doi: 10.1111/acem.13014 **3)** Badawy, M. K., Dayan, P. S., Tunik, M. G., Nadel, F. M., Lillis, K. A., Miskin, M., . . . Kuppermann, N. (2017). Prevalence of Brain Injuries and Recurrence of Seizures in Children With Posttraumatic Seizures. *Acad Emerg Med, 24*(5), 595-605. doi: 10.1111/acem.13168 **4)** Dayan, P. S., Ballard, D. W., Tham, E., Hoffman, J. M., Swietlik, M., Deakyne, S. J., . . . Kuppermann, N. (2017). Use of Traumatic Brain Injury Prediction Rules With Clinical Decision Support. Pediatrics, 139(4). doi: 10.1542/peds.2016-2709 **5)** Dayan, P. S., Holmes, J. F., Hoyle, J., Jr., Atabaki, S., Tunik, M. G., Lichenstein, R., . . . Kuppermann, N. (2015). Headache in traumatic brain injuries from blunt head trauma. Pediatrics, 135(3), 504-512. doi:	**1)** Injury circumstances and frequency of clinically important neurologic complications in pediatric minor blunt head trauma **2)** Accuracy of the pediatric GCS score in preverbal children vs standard GCS score in older children **3)** Frequency of TBIs on CT and short-term seizure recurrence in children with posttraumatic seizures PTS. **4)** CT use after implementation of PECARN TBI prediction rules and clinical decision support (CDS) **5)** Risk of traumatic brain injuries (TBIs) in children with headaches after blunt head trauma **6)** The association between scalp hematoma characteristics and traumatic brain injuries in young children with blunt head trauma	**1)** "Children with minor blunt head trauma and isolated linear skull fractures are at very low risk of evolving other traumatic findings noted in subsequent imaging studies or requiring neurosurgical intervention. Hospital admission for neurologically normal children with isolated linear skull fractures after minor blunt head trauma for monitoring is typically unnecessary." **2)** "Although the pediatric Glasgow Coma Scale score for evaluation of preverbal children with blunt head trauma evaluated in the ED was somewhat less accurate than the standard Glasgow Coma Scale used for older children for identifying those with traumatic brain injuries on CT, it was equally accurate for identifying children with clinically important traumatic brain injuries. Therefore, clinicians and researchers can confidently use the pediatric Glasgow Coma Scale when evaluating preverbal children for clinically important traumatic brain injuries. **3)** "In conclusion, children with posttraumatic seizures after blunt head trauma have a substantial rate of traumatic brain injuries on computed tomography, regardless of timing and duration of the seizure…Therefore, cranial computed tomography scans should be strongly considered in the evaluation of all children with post-traumatic seizures, including those with no PECARN risk factors." **4)** "The implementation of TBI prediction rules and provision of risks of ciTBIs by using computerized CDS was associated with modest but variable decreases in rates of CT use for children at very low risk of ciTBI and for all children with minor blunt head trauma, without increasing the rate of missed injuries. However, decreased CT rates were inconsistent across study sites and secular trends were noted." **5)** "ciTBIS are rare and TBIs on CT are very uncommon in children with minor blunt head trauma when headaches are their only sign and symptom." **6)** "In patients younger than 24 months with isolated scalp hematomas, a minority received CTs. Despite the occasional presence of traumatic brain injuries on CT, the prevalence of clinically important traumatic brain injuries was very low, with no patients requiring neurosurgery. Clinicians should use patient age, scalp hematoma, location and size, and injury mechanism to help determine which otherwise asymptomatic children should undergo neuroimaging after minor head trauma."	*See PECARN table for search terms

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Observation in the emergency department before determining the need for CT appears appropriate for many of these children." **8)** "This study broadens the understanding of the epidemiology of Pediatric TBIs resulting from different sports activities through a prospective assessment of frequency and severity of ciTBIs and ED CT use in a large cohort of head-injured children in a network of pediatric EDs." **9)** "In children with head trauma, CTs are obtained twice as often in children with bleeding disorders, although ICHs occurred in only 1.1%, and these patients had symptoms. Routine CT imaging after head trauma may not be required in children without symptoms who have congenital and acquired bleeding disorders." **10)** "Pharmacological sedation is infrequently used for children with minor BHT undergoing CT, and complications are uncommon. The variability in sedation medications and frequency suggests a need for evidence-based guidelines." **11)** "Both subjective and objective clinical variables in children with blunt head trauma can be assessed by different observers with acceptable agreement, making these variables suitable candidates for clinical decision rules." **12)** "Children with minor blunt head trauma presenting to the emergency department with isolated LOC are at very low risk for ciTBI and do not routinely require computed tomographic evaluation." **13)** "Television tip-overs may cause ciTBIs in children, including death, and the most severe injuries occur in children 5 years or younger. These injuries may be preventable by simple preventative measure such as anchoring television sets with straps." **14)** "Children with nonisolated IVHs after BHT typically present with GCS scores of less than 14, frequently require neurosurgery, and have high mortality rates. In contrast, those with isolated UVHs typically present with normal mental status and are at low risk for acute adverse events and poor outcomes….Therefore, children with isolated IVHs after BHT may be candidates for early hospital discharge or even extended ED observation for clinical signs of deterioration rather than definite hospital admission." **15)** "Children with ventricular shunts had higher CT use with similar rates of clinically important traumatic brain injuries after minor blunt head trauma compared with children without ventricular shunts…Our findings suggest that routine neuroimaging for children with ventricular shunts after minor blunt head trauma may not be required in the absences of signs and symptoms of traumatic brain injury." **16)** "Children with isolated severe injury mechanisms are at low risk of clinically important TBI, and many do not require emergent neuroimaging." **17)** "Disparities may arise from the overuse of cranial CT among patients of nonminority races/ethnicities. Further studies should focus on explaining how medically irrelevant factors, such as patient race/ethnicity, can affect physician decision making, resulting in exposure of children to unnecessary health care risks."	

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	consciousness in children with minor blunt head trauma. JAMA Pediatr, 168(9), 837-843. doi: 10.1001/jamapediatrics.2014.361 **13)** Lichenstein, R., Monroe, D., Quayle, K. S., Miskin, M., Cooper, A., Gerardi, M. J., . . . Kuppermann, N. (2015). Television-Related Head Injuries in Children: A Secondary Analysis of a Large Cohort Study of Head-Injured Children in the Pediatric Emergency Care Applied Research Network. Pediatr Emerg Care. doi: 10.1097/pec.0000000000000605 **14)** Lichenstein, R., Glass, T. F., Quayle, K. S., Wootton-Gorges, S. L., Wisner, D. H., Miskin, M., . . . Kuppermann, N. (2012). Presentations and outcomes of children with intraventricular hemorrhages after blunt head trauma. Arch Pediatr Adolesc Med, 166(8), 725-731. doi: 10.1001/archpediatrics.2011.1919 **15)** Nigrovic, L. E., Lillis, K., Atabaki, S. M., Dayan, P. S., Hoyle, J., Tunik, M. G., . . . Kuppermann, N. (2013). 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Emergency department practice variation in computed tomography use for	trauma but with no other risk factors form the PECARN TBI prediction rules **17)** Patient race/ethnicity and CT use among children with minor blunt head trauma **18)** Factors associated with CT use for children with minor blunt head trauma in EDs **19)** Risk of arachnoid cyst related complications in children evaluated for head trauma **20)** Challenges enrolling children into a TBI trial **21)** Presentations and outcomes of children with basilar skull fractures in the ED after blunt head trauma **22)** PECARN TBI prediction rules compared to clinician suspicion for identifying children with clinically important TBIs (ciTBIs) after minor blunt head trauma **23)** Risk of acute adverse outcomes in children with minor blunt head trauma who had cerebral contusions and no other traumatic brain injuries on CT **24)** Prevalence and significance of incidental findings on cranial CT scans in children evaluated for blunt head trauma **25)** Frequency of neurologic complications in children with minor	**18)** "Substantial variation exists in the use of CT for children with minor blunt head trauma not explained by patient severity or rates of positive CT scans or clinically important traumatic brain injuries." **19)** "In this cohort of 69 children with arachnoid cysts who sustained head trauma, none demonstrated cyst-related bleeding or complications. This suggests the risk of arachnoid cyst-related complications in children following blunt head trauma is low and evaluation should align with existing clinical decision rules." **20)** "Enrolling children with moderate-to-sever TBI into time-sensitive clinical trials will require large numbers of sites and meticulous preparation and coordination and will prove challenging to obtain informed consent given the timing of patient and guardian arrival. The Federal Exception from Informed Consent for Emergency Research will be an important consideration for enrolling these children." **21)** "Approximately 1% of children with blunt head trauma have physical examination signs of basilar skull fracture or basilar skull fracture on CT. The latter increases the risk of acute adverse outcomes more than physical examination signs of basilar skull fracture. A CT scan is needed to adequately stratify the risk of acute adverse outcomes for these children. Children with isolated basilar skull fractures are at low risk for acute adverse outcomes and, if neurologically normal after CT and observation, are candidates for ED discharge." **22)** "The Pediatric Emergency Care Applied Research Network prediction rules for identifying children with clinically important traumatic brain injuries had greater sensitivity than clinician suspicion in both preverbal and verbal children with minor blunt head trauma." **23)** "Children with small isolated cerebral contusions after minor blunt head trauma are unlikely to require further acute interventions, including neurosurgery, suggesting that neither intensive care unit admission nor prolonged hospitalization is generally required." **24)** "A small but important number of children evaluated with CT scans after blunt head trauma had incidental findings. Physicians who order cranial CTs must be prepared to interpret incidental findings, communicate with families, and ensure appropriate follow-up. There are ethical implications and potential health impacts of informing patients about incidental findings." **25)** "Children with blunt head trauma and initial ED GCS scores of 14 or 15 and normal cranial CT scan results are at very low risk for subsequent traumatic findings on neuroimaging and extremely low risk of needing neurosurgical intervention. Hospitalization of children with minor head trauma after normal CT scan results for neurologic observation is generally unnecessary." **26)** Nearly one-half of children with nontrivial blunt head trauma evaluated in the ED may not have a guardian available during their initial ED evaluation. ED research studies of pediatric trauma patients that require written informed consent from a guardian at the time of initial ED evaluation and treatment may have difficulty enrolling targeted sample size numbers and will likely be limited by enrollment bias." **27)** "Clinical observation was associated with reduced computed tomography use among children with minor blunt head trauma and may be an effective strategy to reduce computed tomography use."	

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EMSC Impact and Outcomes References

EIIC	
Topic	**Work Plan Objectives**
Disaster Planning	• The EIIC has helped create a virtual network of collaborators nationally, including the American Academy of Pediatrics chapters with EMSC State Partnership (which are present in 58 states and territories). The network is expanding to include the Emergency Nurses Association, the National Association of State EMS Officials and the American College of Emergency Physicians. The EIIC has and continues to develop and provide evidence based educational materials for both pre-hospital and hospital providers regarding children, specific diseases, and children with special health care needs. Examples include: Pediatric Disaster Preparedness Toolbox **COMPLETED ACTIVITIES** ○ Presented a webinar on Stop the Bleed to train EMSC first responders about the Homeland Security initiative, explain the content taught to prepare the general public for mass casualty events and encourage others to take the trainers course. Total attendees = 106 at live presentation for continuing education credit. The recorded webinar is on the EIIC website for others to access as needed. ○ Active introduction of State EMSC Programs to pediatric partners via AAP chapter and the AAP Disaster Preparedness Advisory Council as well as through the ENA. The EIIC is working on a similar plan to connect ACEP state chapters to the EMSC SP in the coming year. These connections for closer alliances among the various groups responsible for caring for children in along the emergency care continuum. ○ The AAP (via the EIIC newsletter) has also disseminated to the EMSC SP ways in which to engage local pediatricians in EMSC Activities improve coordination and increase discussion with families about disaster preparedness, injury prevention and what to do and where to go if pediatric emergency care is needed. ○ Created Disaster Planning Resources webpage (in collaboration with subject matter experts) on the EIIC website to support healthcare providers, public health agencies, and children's caregivers and families. ○ Conversations with National Pediatric Readiness Steering Committee ○ Promoted NPRP Steering Committee message on the facility recognition collaborative to 63,000 AAP members ○ Surveyed the Disaster Preparedness Chapter Contacts and the AAP disaster experts on pediatricians' involvement in EMSC activities to identify ways to further engage pediatrician. Also, disseminated to the EMSC State Partnerships ways in which to engage local pediatricians in EMSC activities. ○ Developed a list of national subject matter experts on disaster planning. ○ Promoted the EMSC Day during the EMS Week. ○ Promoted EMSC initiatives to the AAP's SOEM and COPEM. ○ Included Disaster Planning questions in the assessment with the preshopital and in-hospital domains to identify national priorities for future education and quality improvement projects. ○ Provided Subject Matter Expert for NASEMSO Ebola and Special Pathogens Expert Panel • Leadership sat on Executive Committee for National Pediatric Executive Committee
Trauma	• The EIIC collaborates with national experts on trauma through organizations including the ACS, the Pediatric Trauma Society, Society of Trauma Nurses, The Joint Commission, the AAP, ENA, EMSC Program, EAST and the Childress Foundation, to define quality measures for the emergency care of injured children. There is currently one main database being used to define quality measures for pediatric trauma: the Pediatric Trauma Quality Improvement Program (Ped TQIP) of the ACS. Pediatric TQIP utilizes the infrastructure of the National Trauma Data Bank (NTDB) to collect valid and reliable data, provide feedback to participating trauma centers, and identify institutional characteristics associated with improved outcomes. The distribution of Pediatric TQIP benchmarking data is limited to those centers participating in the program. • The Pediatric Trauma Assessment and Management Database (PTAM) is a unique and emerging database created with the primary goal of identifying quality indicators that will inform the management of the pediatric trauma population, from emergency response to stabilization to resuscitation care. The database combines trauma registry data that is submitted to the NTDB and the Virtual Pediatric System (VPS), which is a pediatric critical care database. An initial pilot project funded through the Childress Foundation in North Carolina has identified both disparities in emergency care as well as prospective quality indicators for pediatric trauma care. Published data resulting from projects through Pediatric TQIP and published and pilot date from PTAM, as well as PECARN studies related to pediatric trauma and EBG with pediatric implications will be used to identify relevant quality measures for emergency pediatric trauma care that can be iterated and provided to states either as best practices or for study. • During year 2, a limited number of quality measures will be evaluated to determine whether there is sufficient evidence to support a recommendation, and determine those needing additional study/research. Initial discussions will be held with PTS, the ACS COT, the Childress Foundation, the Pediatric Trauma and Critical Illness Branch, and the HRSA EMSC Program regarding collaboration and development of a research agenda to support essential studies for quality measures lacking needed evidence. • During year 2, pediatric trauma subject matter experts will identify a limited number of critical quality indicators addressing the continuum of pediatric trauma care based on potential to improve the care of injured children. Where EBGs exist for chosen indicators, these will be assessed as to impact or lack of in the delivery of pediatric trauma care and

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	plans explored to facilitate knowledge translation and better use of the EBG – i.e. educational webinars collaborating with national partners. Additionally, where EBG do not exist for chosen important pediatric trauma metrics, a research agenda will be discussed with PTS, ACS-COT, Childress Foundation, Pediatric Trauma and Critical Illness Branch, and HRSA EMSC Program regarding collaboration to support essential studies where additional evidence is needed. • Year 3 the EIIC will collect available pediatric trauma EBG linked to critical quality indicators identified in year 2. These will be populated on the EIIC website. Additionally, plans and a timeline will be developed for year 4 development of 1 or 2 additional important pediatric trauma EBG based on critical identified quality indicators. • Year 4: Development of important pediatric trauma quality indicators lacking EBG will commence with national experts. **COMPLETED ACTIVITIES** o Presented a webinar on Stop the Bleed to train EMSC first responders about the Homeland Security initiative, explain the content taught to prepare the general public for mass casualty events and encourage others to take the trainers course. Total attendees = 106 at live presentation for continuing education credit. The recorded webinar is on the EIIC website for others to access as needed. o Supported Dr. Mary Fallat's work with the Childress Foundation to assist with the development of a report that can inform decision makers at the state and federal levels on the State Trauma System Planning and Development devoted to children. o Supported Dr. Mary Fallat's work with AHRQ to develop a quality improvement collaborative designed to develop and evaluate quality metrics for processes of care along the pediatric continuum of care. o Complied a wide range of Trauma metrics as they relate to processes of care along the pediatric continuum of care. • Supported attendance of Dr. Mary Fallat and Diana Fendya, MSN, RN-R to Road to Zero meetings
Behavioral health: National Resource Center/ EMS for Children Innovation and Improvement Center	**1)** Chun, T. H., Mace, S. E., & Katz, E. R. (2016). Executive Summary: Evaluation and Management of Children and Adolescents With Acute Mental Health or Behavioral Problems. Part I: Common Clinical Challenges of Patients With Mental Health and/or Behavioral Emergencies. Pediatrics, 138(3). doi: 10.1542/peds.2016-1571 **2)** Chun, T. H., Mace, S. E., & Katz, E. R. (2016). Executive Summary: Evaluation and Management of Children With Acute Mental Health or Behavioral Problems. Part II: Recognition of Clinically Challenging Mental Health Related Conditions Presenting With Medical or Uncertain Symptoms. Pediatrics, 138(3). doi: 10.1542/peds.2016-1574 **1)** "The clinical reports are organized around the common clinical challenges pediatric caregivers face, both when a child or adolescent presents with a psychiatric chief complaint or emergency (part I)…Part II of the clinical reports includes discussions of somatic symptom and related disorders, adverse effects of psychiatric medications including neuroleptic malignant syndrome and serotonin syndrome, caring for children with special needs such as autism and developmental disorders, and mental health screening." **2)** "…and also when a mental health condition may be an unclear or complicating factor in a non-mental health clinical presentation (part II). Part I of the clinical reports includes discussions of Medical Clearance of Pediatric Psychiatric Patients, Suicide, and Suicidal Ideation, Restraint of the Agitated Patient Including Verbal, Chemical, and Physical Restraint, and Coordination of care With the Medical Home…" The National Resource Center and the EMS for Children Innovation and Improvement Center have supported development of policy and clinical standards for care delivery for mental health emergencies in children (including autistic spectrum disorders, mental health screening, suicide and the agitated patients). The need to address and create a national strategy for mental health emergencies in children is critical and EMSC has helped support the integration of the behavioral health screening and interventions in a non traditional setting (the EMSC continuum).
Septic shock	The EIIC has partnered with multiple professional societies collaborating on evidence based pathways for emergency care settings. This has enhanced support of septic shock QI collaboratives, the most recent having decreased mortality from septic shock.

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