

# PEM TODAY

Translating Science to Stretcher in Pediatric Emergency Medicine

## High-Fidelity in a Search for a High-Impact

High-Fidelity Simulation is rushing into our professional- educational life at a very high speed. Tens of thousands of dollars worth of computerized machines are providing us with as close to real life experiences as possible, thus preparing us for the next resuscitation in the ED. However, there has been no groundbreaking research so far. There is little evidence to show the benefits of simulation compared to the 30 minute "gather here" mock code in the empty trauma/critical-care room.

**Donoghue et al** from the Emergency and Critical Care areas in The Children's Hospital of Philadelphia (CH-OP), published in *Pediatric Emergency Care* Journal a randomized trial comparing High-Fidelity Simulation and non-High-Fidelity Simulation (the same mannequin but with-out the life-like-experience) on pediatric residents doing a PALS course. In a group of 51 residents, pre-simulation performance was similar between the 2 groups, but the improvement in scores in the simulation group was higher (11.1 (SD 4.8) and 4.8 (SD 1.7) with  $p=0.007$ ) for High and non-High-Fidelity simulation groups respectively.

This is an excellent study with very positive results, yet all simulation-based research these days experience quite a few limitations.

First, the sample size in these trials is usually small due to the limited groups of learners in each institution. The same applies to the generalizability of the findings. Effective measures employed in one institution through the scenario used and the specific team operating the simulator, nonetheless may not be as effective in other places. Hence, it seems that future evidence should come from multicenter, larger trials with a lot of consistency in the methodology used between centers.

Secondly, there is the blinding issue. When randomizing, investigators will want to be blind to the intervention. This is practically impossible when the intervention is as obvious as the trainees' actions in response to a mannequin that does or does not 'respond'. Blinding to the main outcome measure (successful resuscitation, teamwork, debriefing etc) is a possibility. The problem is that current methodology in the area does not provide truly validated measurement tools and these need further development.

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Finally, in order to put simulation in the center of PEM teaching, we need some longer term studies showing that retaining the knowledge gained is truly better than if you just read a book or use good-old Annie.

Despite all the challenges, simulation-based research in PEM (and other specialties) is moving forward quickly with great ideas and motivation from many centers. We will eventually discover if this learning method is the next best thing.

– **Ran Goldman**

**Read More :** Donoghue AJ, Durbin DR, Nadel FM, Stryjewski GR, Kost SI, Nadkarni VM. Effect of high-fidelity simulation on Pediatric Advanced Life Support training in pediatric house staff: a randomized trial. *Pediatric Emergency Care*. 2009;25(3):139-44

# Who is Seeing Children in the Emergency Department ?

The numbers are quite clear. Only 7% of US children are seen specifically in Pediatric Emergency Departments, and only 23% are seen by pediatric emergency specialists. The first graduate of PEM training in England completed his training in 2007. In many other countries, Pediatric Emergency Medicine was recognized as a subspecialty only in the last several years - the most recent countries being Turkey and Israel. Are our children receiving the quality of care they deserve if this is the current state of PEM worldwide?

**Prentiss and Vinci** did a literature review to answer the question: "What is the clinical impact on children cared for in systems without access to PEM providers?"

The mission was impossible. The eighteen studies found mostly dealt with service provided for children with trauma or fever.

The authors concluded that children with trauma have better health outcomes (lower mortality and lower rate of Splenectomies) if they are cared for by pediatric specialists. But these are usually the pediatric surgeons or traumatologists, not PEM physicians. The outcome of febrile children is even less clear as the research concentrated solely on guidelines and tests. Thus, the question is left unanswered. What is crystal clear from their review in *Archives Disease of Childhood* is that we must fold our sleeves and conduct research that will evaluate the outcome of pediatric patients requiring urgent care.



If we truly want to promote quality of care in the acute care setting, it is this type of research that will influence decision makers and funding agencies.

- David Smith

**Read More :** Prentiss KA, Vinci R. Children in emergency departments: who should provide their care? *Arch Dis Child*. 2009;94(8):573-6

## PEM TODAY

*Translating Science to Stretcher in Pediatric Emergency Medicine*

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## Cough Syrup Scare

In the 1970s, while codeine was commonly used as a cough suppressant, teens were simply abusing the drug. Dextromethorphan replaced codeine as the over-the-counter (OTC) cough drug, but teens could still get a 'high' by taking large doses. We now know the risks of OTC cough and cold medications for young infants. Manufacturers have voluntarily ended marketing them to children < 2 in light of these safety concerns. **Dart et al** from the Rocky Mountain Poison and Drug Center in Denver, Colorado convened a panel of experts to look at fatalities that involved children < 12 years who had cough and cold ingredients mentioned in information



obtained from 5 sources (literature, manufacturers' reports, FDA sources). They were trying to determine the causal relationship between medication ingestion and death.

The majority of findings, published in *Annals of Emergency Medicine*, were not so surprising. Of the 189 cases analyzed, 118 were judged possibly, likely, or definitely related to a cough and cold ingredient. 103 cases involved a nonprescription drug, and of these, 88 involved an overdose. The panel suggested that children < 2 years old, doubling up on the drug (2 medicines with the same ingredient), use in a daycare setting, failure to use a measuring device, product misidentification, and use of adult nonprescription product, were all factors associated with the deaths.

What was astounding in the findings was that death was associated with caregivers' non-therapeutic intent. Some caregivers admitted their intent was to sedate the child. Another finding of extreme concern was that homicide was suspected in 10 of the death cases.

Thus, instead of treating the child with a product that barely relieves symptoms on a temporary basis and is likely to be ineffective for cough and cold infections, we need to focus on the parents who use these OTCs, and invest in educational efforts to

avoid ongoing misuse. As emergency physicians, we can save more lives by educating parents every time they step through our door.

- Jane Kristal

**Read More :** **Dart RC**, Paul IM, Bond GR, Winston DC, Manoguerra AS, Palmer RB, Kauffman RE, Banner W, Green JL, Rumack BH. Pediatric fatalities associated with over-the-counter (nonprescription) cough and cold medications. *Ann Emerg Med.* 2009;53(4):411-7

## PEM TODAY Editorial Note

.....With the evolution of Pediatric Emergency Medicine, we are witnessing the growing collection of a large number of good studies, unfortunately with very little time to read them. In today's fast paced environment, clinicians rely on multiple sources of information. One field that has seen growth is newsletters with synopses of recent research.

The commentaries we provide for you in this new newsletter are not aimed at scrutinizing or emphasizing the limitations of studies. These are summaries of recent, interesting findings in Pediatric Emergency Medicine, coupled with fair amounts of insight and wisdom from PEM practitioners.

PEM Today is all about you, the reader. The distinguished Editorial Board will try to serve your needs, aim to publish concise, insightful and thought-provoking ideas to promote the field of Pediatric Emergency Medicine, support knowledge translation and knowledge transfer, as well as advance research in our evolving field.  
..... -Ran Goldman

# To the Point



Infants with respiratory syncytial virus (RSV) who received 200 µg beclomethasone dipropionate twice daily administered by a pressurized metered dose inhaler and a spacer during the first three months after hospital admission, did not benefit compared to those administered with the placebo when recurrent wheeze was evaluated.

*read more:* **Ermers et al. BMJ.** 2009;338:b897

There is significant practice variation when it comes to diagnosing children <2 years with lower respiratory tract infection symptoms in the ED. Many are given the diagnosis of "asthma", and they are more likely to receive corticosteroids. The authors of one study hope to work on evidence-based and outcome-based definitions for lower respiratory tract infections, in order to guide diagnosis and treatment.

*read more:* **Mansbach et al. Pediatrics.** 2009 ;123(4):e573-81

The Resuscitation Council in the UK recently published a set of new guidelines and a simple algorithm for the acute management of anaphylaxis. Only some teaching points on recognition of an anaphylactic reaction were changed. Treatment, however, remains unchanged. Get them Epinephrine (adrenalin), antihistamines and steroids.

*read more:* **Tse et al. Arch Dis Child Educ Pract Ed.** 2009;94(4):97-101

Trampolining is bad for your health. In the UK, 131 children presented to the ED with trampolining injuries (1.5% of pediatric attendances). A third had fractures, 14% ended in the OR, and another 14% needed laceration repair. A combination of inadequate adult supervision, several people using a trampoline simultaneously and insufficient safety, all enhanced injury.

*read more:* **Wootton et al. Emergency Medicine Journal** 2009;26:728-731;

Do we need to do a lumbar puncture (LP) on every child with complex febrile seizures ? According to Seltz et al from Toronto, Canada, the answer is no. Retrospective chart review of children 6 months to 6 years with febrile convulsion, meningitis, or encephalitis found 390 complex febrile seizures and an LP that was done on 146 (37%). Six had bacterial meningitis (all with *Streptococcus pneumoniae*) and one had HSV encephalitis. All but one were transferred to General Pediatrics. For those initially presented to the ED, the rates were very low (bacterial meningitis 0.3% (95% CI, 0.0-1.8) and HSV encephalitis 0.0% (95% CI, 0.0-1.2)).

*read more:* **Seltz et al. Pediatr Emerg Care.** 2009;25(8):494-7

A pediatric asthma clinical practice guideline made modest changes in an Australian tertiary pediatric ED. Physicians increased use of spacer (17 → 26%), reduced use of ipratropium (58 → 44%), unchanged use of corticosteroids. More action plans for patients were prepared and the rate of chest x-ray and hospital admissions decreased.

*read more:* **Gildenhuis et al. Int J Emerg Med.** 2009;2(1):33-9

## Managing Febrile Infants – Are We Consistent ?

What are we to do with the febrile infant? We have all agonized over and probably even lectured residents on this age-old/perpetual question. Even though this is a very common scenario, there are no endorsed guidelines from Pediatric or Emergency Medicine organizations worldwide regarding the management of these infants. Many studies in our field have made recommendations for some “normative approaches.” For example, full sepsis work up until 2-3 months of age but these aren't routinely followed. This wide range in practice variation has often been attributed to differences in the training of the physician performing the evaluation. The different forms of training include Family Medicine, Pediatrics, Emergency Medicine and Pediatric Emergency Medicine.

The primary objective of the new study by **Goldman et al**, from the Pediatric Emergency Research Canada (PERC) group, was to determine the variability in work up and treatment of infants  $\leq 90$  days old seen in pediatric EDs across Canada. If education background is the major factor determining the previously demonstrated variability, this study will demonstrate the uniformity of decision making by doctors in the field of PEM.

Well...that is not the case. A total of 257 infants  $\leq 90$  days old with a rectal temperature of  $\geq 38^\circ\text{C}$  were recruited from 6 pediatric emergency centers during the winter/early spring over a 2-4 month period.

There was no major difference in the demographics of the various sites. Thirty percent of the time, the doctors who performed the exam suspected the infant had a bacterial infection. Blood cultures were performed in 89% of the patients (range in the 6 centers was 83-95%). Urine cultures were performed in 86 % (range 78-95%) and lumbar puncture in only 42% (range 24-62%). Respiratory viral tests were performed on 44 % of the patients (range 12-72%). Antibiotics were given to 55% (range 48-76%) and 64% were admitted (range 56-80%).

One major limitation of the study is the lack of data concerning the treatment decision for the various sub-populations based on ages (0-1mo, 1-2mo and 2-3mo). Only one quarter were under 1 month of age and much of the variability may have been in the  $>2$  month olds. which is less revealing to me. The original Boston, Phila and Rochester studies had variability with age cut offs; only Boston went to 3 months. Additionally, those studies determined treatment and disposition based on high and low risk stratification.

None of this information was given in the current study and therefore, interpretation of antibiotic use and admission rate without this stratification is not particularly helpful. An additional limitation in this study is that only 70-90% of physicians were PEM certified. Thus, the presumption of the uniformity of their education is not accurate.

Despite these detractors, this study reveals that even though much has been published on the general approach to the febrile newborn (even with respiratory illnesses), PEM doctors are not adhering to a “normative approach.”

Something noteworthy is that this data was gathered after **Levine et al** of the Pediatric Emergency Medicine Collaborative Research Committee of the American Academy of Pediatrics in 2004, addressed the febrile infant who was RSV positive. The study demonstrated a 40% reduction but still a 7% rate of serious bacterial infections the overwhelming majority which were UTIs. Additionally, the Goldman data was gathered prior to the publication of **Krief et al** from the same AAP committee in 2009, which determined the risk of SBI in febrile infants who were influenza positive. The study revealed that those with influenza had a significantly lower prevalence of SBI in all categories.

- **Joshua Rocker**

**Read More :** **Goldman RD**, Scolnik D, Chauvin-Kimoff L, Farion KJ, Ali S, Lynch T, Gouin S, Osmond MH, Johnson DW, Klassen TP. Fever in Infants Group Research, Pediatric Emergency Research of Canada. Practice variations in the treatment of febrile infants among pediatric emergency physicians. **Pediatrics**. 2009;124(2):439-45

**Krief WI**, Levine DA, Platt SL, Macias CG, Dayan PS, Zorc JJ, Feffermann N, Kuppermann N. Multicenter RSV-SBI Study Group of the Pediatric Emergency Medicine Collaborative Research Committee of the American Academy of Pediatrics. Influenza virus infection and the risk of serious bacterial infections in young febrile infants. **Pediatrics**. 2009;124(1):30-9.

**Levine DA**, Platt SL, Dayan PS, Macias CG, Zorc JJ, Krief W, Schor J, Bank D, Feffermann N, Shaw KN, Kuppermann N; Multicenter RSV-SBI Study Group of the Pediatric Emergency Medicine Collaborative Research Committee of the American Academy of Pediatrics. Risk of serious bacterial infection in young febrile infants with respiratory syncytial virus infections. **Pediatrics**. 2004;113(6):1728-34

# Fracture Pain Management Revisited

There is a lack of evidence regarding the best management of pain in children with fractures, leading to a substantial practice variation among emergency physicians. In a recent study, **Drendel et al.** compared the efficacy of the two most repeatedly used analgesics for children with an arm fracture. This was a randomized controlled trial with a convenience sample of children 4 to 18 years old with a simple fracture of the humerus, radius or ulna not necessitating manipulation. The two interventions were ibuprofen (10mg/kg) vs. acetaminophen and codeine (1mg/kg) administered every 4 to 6 hours with a maximum of 4 doses per day. The dosage of acetaminophen was not specified. The primary outcome was the use of rescue medication for pain. The expectation of the investigator was that the use of ibuprofen would result in a lower proportion of rescue medication (going from 30% in the codeine group to 15% in the ibuprofen group).

Among the 361 eligible patients who were approached, 336 were enrolled. After the exclusion of 12 participants (absence of a fracture or protocol violation) and 80 participants who were lost to follow-up, 244 participants were analyzed.

The study nearly reached statistical significance for the primary outcome, as demonstrated by a lower proportion of rescue medication

for patients receiving ibuprofen (20.3%) vs. acetaminophen/codeine (31.0%) with a difference of 10.7% (95% CI of -0.2% to 21.6%). Also, patients randomized to ibuprofen reported less impact on their functional outcomes and had a lower median daily pain score.



On the other hand, patients randomized to codeine reported a higher proportion of adverse events (50.9% vs. 29.5%). These were mainly related to nausea and vomiting. All measures of satisfaction were in favor of ibuprofen.

A main concern of orthopedics is related to the theoretical risk of slower bone healing associated with ibuprofen. Drendel et al. had an interesting observation. They followed patients for more than one year. During this period, 4 children refractured the same arm (3 with codeine and 1 with ibuprofen). The main conclusion of this study is that ibuprofen is at least as good as acetaminophen/codeine for the treatment of pain in children with an arm fracture. It also has less adverse events.

The two major limitations of the study were related to the fact that it was a convenience sample, and that a relatively high proportion of patients were excluded and lost to follow-up (25%). However, this should not affect the internal validity of the results. It seems that even in the worst case scenario, acetaminophen/codeine would not have become more effective than ibuprofen. Thus, in the battle between ibuprofen and acetaminophen/codeine for pain related to fracture, it seems that ibuprofen is winning. In an era where codeine is receiving a bad reputation for causing constipation and genetic based risk profiles, the lead for ibuprofen is noteworthy.

- Jocelyn Gravel

**Read More :** Drendel AL, Gorelick MH, Weisman SJ, Lyon R, Brousseau DC and Kim MK. A Randomized Clinical Trial of Ibuprofen Versus Acetaminophen With Codeine for Acute Pediatric Arm Fracture Pain. *Ann Emerg Med* 2009 Aug

# Ultrasound Everywhere (in the PED)

In the midst of alternating between the MP3, iPod and Blackberry, PEM docs have also been playing with the Ultrasound machine for several years now. In some places (though not to the delight of the Radiology Department), the support of the already experienced general EM and evolutions of PEM-Ultrasound fellowships has enabled us to see more and more white snow on screens across the world.

There is a wide range of indications for ultrasound out there and research is “popping up” constantly to show us transducer-based magic.

One of the issues to consider among groups using ultrasound is the amount of liability one should undertake.

Examples like peripheral venous puncture, central venous access, FAST, intussusception and appendicitis, are only a few in a list that is steadily growing.

Should the ED doc rely on his/her limited experience to determine if a testicle or an ovary is torsed? Should an equivocal test with appendicitis suffice to send a child home?

Also, should training now be a part of every fellowship program?

Based on the amount of research out there, it seems that there is no going back. US is certainly making its strong presence known in the PED.

- John Kelner



**Read More :** Kairam N, Kaiafis C, Shih R. Diagnosis of pediatric intussusception by an emergency physician-performed bedside ultrasound: a case report. *Pediatr Emerg Care.* 2009 ;25(3):177-80.

**Doniger SJ,** Ishimine P, Fox JC, Kanegaye JT. Randomized controlled trial of ultrasound-guided peripheral intravenous catheter placement versus traditional techniques in difficult-access pediatric patients. *Pediatr Emerg Care.* 2009;25(3):154-9.

**Dietrich AM,** Coley BD. Bedside pediatric emergency evaluation through ultrasonography. *Pediatr Radiol.* 2008 Nov;38 Suppl 4:S679-84

**Ramirez-Schrempp D,** Dorfman DH, Baker WE, Liteplo AS. Ultrasound soft tissue applications in the pediatric emergency department: to drain or not to drain? *Pediatr Emerg Care.* 2009;25(1):44-8.

**Levy JA,** Bachur RG. Bedside ultrasound in the pediatric emergency department. *Curr Opin Pediatr.* 2008;20(3):235-42



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# Predicting the Need for CT Scan in Pediatric Patients with Minor Head Injuries

Pediatric head injuries are a common presentation in the Emergency Department. Yet, we do not know which patients with minor head injuries require CT scanning and there is a marked variability in practice. While CT scan is the gold standard for detecting intracranial injury (their rate doubled between the years 1995-2005), radiation exposure risk is now unmistakable and 1 in 1000 head scans can result in a lethal malignancy. Furthermore, young children may require sedation which has inherent risks. There are also the added costs related to expertise and staff.

In a recent systematic review in *Pediatrics*, **Maguire et al** from **Toronto**, Canada looked at the literature for prediction rules to identify patients with head injuries that would require CT scanning. From all the studies identified, only 8 prediction rules (one was retrospective) were identified, none of which were validated. Each study used different patient age cohorts and different outcomes. There is no consensus on what is considered important, namely, whether it is any intracranial injury or an injury that requires intervention. Only 2/8 attempted to identify clinically meaningful outcomes.

**Kuppermann et al** from the **Pediatric Emergency Care Applied Research Network (PECARN)** published in *Lancet* the largest study ever on the topic (32 authors, 109 collaborators, over 42,000

children). They prospectively derived and validated a rule to identify children with GCS 14 or 15 of clinically important brain injuries (death, brain surgery, intubation > 24 hours or admission for  $\geq 2$  nights) that would not require a CT scan. They stratified patients to less than 2 years and over 2 years.

For children less than 2 years of age, factors such as a GCS of <15, altered mental status or palpable skull fracture, would mandate a CT scan. Any non-frontal hematoma, LOC for 5s or more, a severe mechanism of injury or not acting normally as per a parent, would require either observation or CT scan based on other factors. A CT scan is also recommended for patients over the age of 2 years with a GCS <15, signs of altered mental status or signs of basilar skull fracture. For those with a history of LOC, vomiting, severe mechanism of injury or severe headache, an observation or CT would be required depending on the clinical situation.

The NPV and sensitivity of the prediction rule were 100% during the validation phase in children < 2 years, and 99.95% and 96.8% respectively, for those over the age of 2 years.

This study has several limitations that need to be considered. There were over 13,000 patients who were not enrolled for analysis, but the study did follow up on the majority and found no demographic differences. Furthermore, the rate of CT scanning among the physicians was much lower than the national average based on their expertise from pediatric centers.

Further validation study that included community EDs would enhance the generalizability of the conclusions.

Not very often do we encounter such a large study on such a fundamental issue in PEM. The simple rules are easy to follow and provide a means to determine if we can avoid a CT. The remaining question is whether or not these decision rules will truly reduce the rate of CT. The answer is likely dependant on the current rate of access and utilization of head CT. As always, destiny is a matter of geography.

- **Rahim Valani**

**Read More :** **Maguire JL**, Boutis K, Uleryk EM, Laupacis A, Parkin PC. Should a head-injured child receive a head CT scan? A systematic review of clinical prediction rules. *Pediatrics*. 2009;124(1):e145-54

**Kuppermann N**, Holmes JF, Dayan PS, Hoyle JD Jr, Atabaki SM, Holubkov R, Nadel FM, Monroe D, Stanley RM, Borgialli DA, Badawy MK, Schunk JE, Quayle KS, Mahajan P, Lichenstein R, Lillis KA, Tunik MG, Jacobs ES, Callahan JM, Gorelick MH, Glass TF, Lee LK, Bachman MC, Cooper A, Powell EC, Gerardi MJ, Melville KA, Muizelaar JP, Wisner DH, Zupan SJ, Dean JM, Wootton-Gorges SL; Pediatric Emergency Care Applied Research Network (PECARN). Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. *Lancet*. 2009;374(9696):1160-70