

# This Month In **The JOURNAL** of **PEDIATRICS**

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## Sepsis screening... does addressing one problem lead to another?

— Denise M. Goodman, MD,  
MS

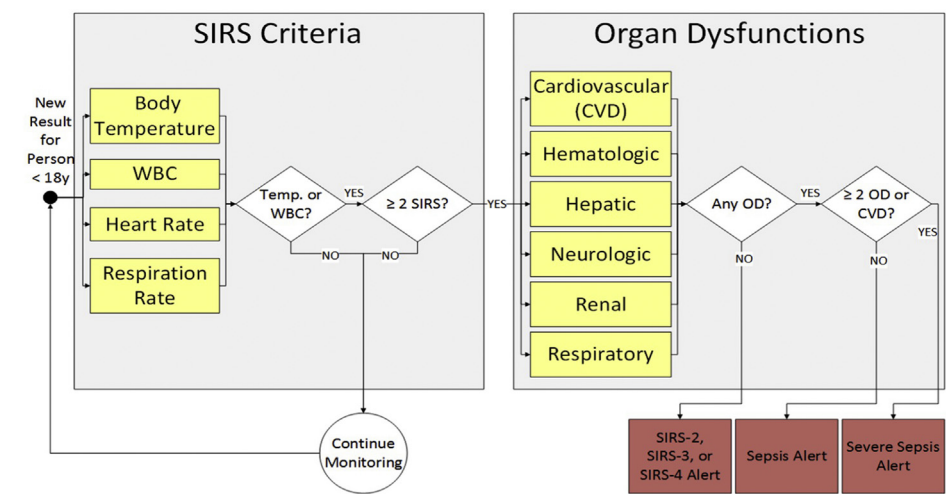
In the wake of widely publicized events where children died from sepsis misidentified as another condition, numerous states have enacted laws requiring hospitals to implement evidence-based processes to quickly recognize sepsis and intervene where appropriate (<https://www.cdc.gov/hai/pdfs/sepsis/V5-Sepsis-Policy-FINAL.pdf>). These include Gabby's law in Illinois and Rory's Regulations in New York. Although these initiatives have sparked lively conversation about the proper role for legislation in clinical care, particularly when prompted by single cases, the mandates have demonstrated success (*JAMA* 2018;320:358-67). The problem of appropriately recognizing sepsis is real, particularly in emergency departments not accustomed to caring for children. However, one argument frequently advanced is that such mandates may lead to unnecessary and inappropriate interventions in children who do not need them. The study by Baker et al in this volume of *The Journal* sought to answer that question.

This single center study implemented a sepsis screening algorithm in the electronic health record (EHR) (Figure). As is common when implementing electronic alerts, the screen was first silent to providers to ensure that it functioned appropriately in the EHR. Subsequently the alert was activated for use in real time. This provided a unique opportunity to compare 2 time epochs, where the screening alert identified patients in an identical fashion, but during 1 period was functioning silently in the background and then in a later period was visible to the clinical team. In this study the investigators focused on false positive screens. Sepsis screens are well known to have a high false positive rate, as a number of conditions may produce the constellation of clinical findings for which sepsis should be in the differential diagnosis. Their intent is to prompt a careful patient evaluation, not a prescribed intervention, to enhance clinical acumen, not substitute for clinical judgment. In comparing the 2 periods they found that there was no difference in receipt of antibiotics or fluid boluses for patients who initially screened positive but did not have sepsis. Clinicians did not react to a positive screen by providing unnecessary interventions.

This is reassuring news, and refutes the contention of skeptics that sepsis screens lead to unwarranted and costly care. However, it does not completely eliminate the concern. This study reflects practice in a quaternary care pediatric hospital with broad experience in both pediatric sepsis and in look-alike presentations. A parallel study in non-pediatric settings will help refine these findings and could further enhance pediatric sepsis care.

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**Cardiovascular Dysfunction**

- Low systolic blood pressure
- Vasoactive drug administration
- Two of the following:
  - Low arterial bicarbonate
  - High arterial lactate
  - Prolonged capillary refill (>3 seconds)\*
  - High core to peripheral temperature gap
  - Abnormal pulse quality \*
  - Abnormal skin assessment \*

**Respiratory Dysfunction**

- Low PaO<sub>2</sub>/FIO<sub>2</sub> in absence of cyanotic heart disease
- High or large increase in PaCO<sub>2</sub>
- High FIO<sub>2</sub>

**Neurologic Dysfunction**

- Low or large decrease in Glasgow Coma Score
- Documentation indicating low mental status\*

**Hematologic Dysfunction**

- Low or large decrease in platelet count
- High international normalized ratio (INR)
- Low absolute neutrophil count (ANC < 0.5 × 10<sup>9</sup>/mm<sup>3</sup>)\*

**Renal Dysfunction**

- High or large increase in serum creatinine

**Hepatic Dysfunction**

- High bilirubin
- High alanine transaminase (ALT)

**Figure.** Sepsis screen algorithm logic used in EHR-embedded alert. Sepsis screening algorithm logic.<sup>13</sup> Additions and changes to Goldstein et al definitions are marked with an asterisk (\*); removals are oliguria and need for mechanical ventilation. FIO<sub>2</sub>, fraction of inhaled oxygen; OD, organ dysfunction; PaCO<sub>2</sub>, partial arterial pressure of carbon dioxide; PaO<sub>2</sub>, partial arterial pressure of oxygen; SIRS, systemic inflammatory response syndrome.

**Why so much AKI lately?**

— Thomas R. Welch, MD

Regular readers of our, and other, journals have probably noted an increasing number of papers on acute kidney injury (AKI) in hospitalized children. Why is this? Independent of any actual change in incidence, a major contributor to such studies has been better definitions of pediatric AKI. Older studies may have relied on definitions derived in adults, which because of a reliance on serum creatinine probably underestimate kidney injury in small children and especially in newborns.

In the past decade, a general consensus has developed on AKI definition, referred to as the Kidney Disease Improving Global Outcomes (KDIGO) guidelines. Specific neonatal definitions (nKDIGO) have also been developed. With these tools in hand, clinical investigators have begun to reassess the risk of kidney injury in a host of pediatric settings.

A nice example of this type of study is reported in the current volume of *The Journal* by Coggins et al. These investigators examined the risk of AKI in neonates with sepsis, comparing a group of children with proven sepsis to a matched group who had negative sepsis investigations. The findings are sobering. Twenty percent of neonates with proven sepsis met the nKDIGO criteria for AKI. Although a not-insignificant number of controls (8%) also had AKI, the severity of kidney injury was greater in the infected babies. The presence of AKI was independently associated with mortality.

It should be noted that most of the babies with AKI had rather mild kidney involvement, and few required renal replacement therapy. Indeed, in an earlier era, most would not have been diagnosed with AKI. As the authors note, we really do not understand the long-term consequences of pediatric AKI. Data in adults point to an increased risk of chronic kidney disease and hypertension, but current data in children are lacking. Papers such as this point to the need for careful follow up of kidney function and blood pressure in such children, as well as attention to potentially modifiable factors that may contribute to this increasingly recognized phenomenon.

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## Individualized dextrose dosing for neonatal hypoglycemia

— Raye-Ann deRegnier, MD

Newborn infants at risk for hypoglycemia are typically managed with feedings or the administration of dextrose gel. Despite these measures, many infants require admission to a special care nursery or neonatal intensive care unit (NICU) for intravenous dextrose. Unfortunately, NICU admission separates mothers and infants, and may lead to the unintended consequence of difficulties in establishing breastfeeding. Therefore, it is important to investigate methods of management of hypoglycemia that decrease separation of mothers and infants and reinforce breastfeeding. In this volume of *The Journal of Pediatrics*, Sen et al describe shorter NICU stays after a protocol change that utilized admission glucose levels to titrate the initial dose of intravenous dextrose for infants with hypoglycemia. As the study was not a clinical trial, more research on the safety and effectiveness of this approach is needed to support translation into widespread practice. However, the results of this study will be good news for neonatologists who struggle with the unintended consequences when otherwise healthy newborn infants are brought into the NICU with low blood sugar.

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## Who's doing the LP?

— Thomas R. Welch, MD

Pediatricians who completed their training a few decades ago likely recall devoting a lot of time to the performance of procedures—often while sleep-deprived and frequently with minimal supervision. Although this arrangement may not have been ideal for children, it probably produced skilled technicians. Lumbar puncture was the archetypical example of such procedures.

Over the ensuing years, a host of factors have shaped this experience significantly. Changes in disease incidence and evidence-based modification of procedural indications are clearly impactful. Additionally, education-focused changes in duty hours have reduced the potential exposure of trainees to a declining number of procedures. Finally, practice changes such as more robust attending presence, along with the ready availability of advanced practice providers, may further decrease the opportunities for trainees to perform lumbar punctures and similar procedures.

Although many have speculated on the impact of these changes on the resident experience, good data have been difficult to obtain. In this volume of *The Journal*, Geanacopoulos et al from Boston examine data from 29 US children's hospitals over the decade spanning 2009 to 2019. Their data are complicated but seem to suggest that the average graduating pediatric resident today may have performed half or fewer lumbar punctures than colleagues from a decade ago.

The authors are careful to avoid conclusions regarding competence in their report. How many procedures constitute “competence?” Are there ways of achieving or assessing competence beyond actual performance? How should programs, or certifying bodies, insure competence? These are questions clinical educators will need to confront in the coming years. Data such as those in this report will help to inform their discussions.

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## Puberty and the definition of overweight and obesity

— Stephen R. Daniels, MD, PhD

The prevalence of overweight and obesity among children and adolescents is obviously high in the United States. However, the best way to define overweight and obesity in young individuals has been a topic of debate. Historically, the approach has been to use percentile values for body mass index by age and sex produced by the Centers of Disease Control and Prevention. However, some have argued that this approach is not optimum for a range of reasons. One concern has been the impact of puberty on growth in height and weight, suggesting that age and sex alone are not adequate as control variables.

In this volume of *The Journal*, Bomberg et al evaluated the impact of including pubertal maturation to characterize weight status by comparing the prevalence of overweight and obesity before and after adjusting for Tanner stage. They found that adjusting for pubertal status reduced the prevalence of overweight and obesity. Whether this approach would be practical from a clinical perspective remains an open question. However, from a qualitative standpoint, it is worth considering, especially for early maturers, when considering a diagnosis of overweight or obesity.

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