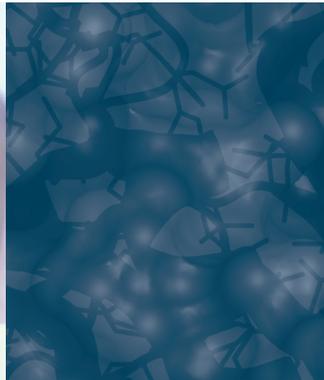


# INNOVATIONS IN PEDIATRICS



## **A Longitudinal Look**

page 4

## **3**

A Difficult  
Diagnosis

## **6**

Laser  
Dentistry

## **7**

Data-Driven



**DAVID SPEICHER, MD**

*Pediatric Critical Care,  
UH Rainbow Babies & Children's Hospital  
Assistant Professor,  
Case Western Reserve University School of Medicine*

## *Quality-Improvement Initiative Reduces PICU Bladder Catheterizations*



Catheter-associated urinary tract infection (UTI) is the third most common nosocomial infection in children, according to the most recent data from the Ohio Children's Hospitals Solutions for Patient Safety National Children's Network. "Catheterization increases the risk of UTI. It's a minuscule increase, but it's there," says David Speicher, MD, an intensivist in the Pediatric Intensive Care Unit (PICU) at University Hospitals Rainbow Babies & Children's Hospital.

To try to drive bladder catheterizations down in the PICU, Dr. Speicher and his colleagues looked to a noninvasive option – the bedside bladder ultrasound. "We wanted to determine whether this technology could reduce the number of invasive bladder catheterizations necessary for PICU patients who are unable to communicate the need to void, whether because of neurological impairment or intubation and sedation," he says. Although previous research had shown that bedside bladder ultrasound could increase the rate of successful catheterization in children under age 2, there were no studies of whether using the technology could prevent unnecessary bladder catheterizations.

To answer the question, Dr. Speicher and his colleagues scanned 61 PICU patients prior to bladder catheterization, noting the scan-generated bladder volume and actual urine volume retrieved via catheterization. They also calculated age-based bladder capacity for each patient. Correlating ultrasound-generated bladder volume estimates with actual volumes retrieved via catheterization, they found that 31 of the 61 patients had urine volumes collected that were less than calculated capacity – and that the bedside ultrasound would have picked that up in 29 of the 31 cases. The team published its findings in the journal *Clinical Pediatrics*.

UH Rainbow Babies & Children's Hospital has incorporated these findings into its patient protocols and now routinely performs bedside bladder ultrasounds in the PICU, increasing safety and peace of mind for pediatric patients and their families. Dr. Speicher says he hopes the practice spreads to other hospitals. "We hope our findings lead to a decrease in the number of invasive procedures performed, and thus a decrease in infection risk, and remove a stressor that families must experience during their hospital stay," he says.

Contact Dr. Speicher at [Peds.Innovations@UHhospitals.org](mailto:Peds.Innovations@UHhospitals.org).

# A Difficult Diagnosis

## FINELY HONED CLINICAL SUSPICION, TEAMWORK PAY OFF “BIG” FOR YOUNG PATIENT

When pediatric intensivists Veera Allareddy, MD, and Steven L. Shein, MD, first saw 5-month-old Ezra in the PICU at University Hospitals Rainbow Babies & Children’s Hospital, he was struggling to breathe. Given the infant’s age and clinical presentation, the PICU team suspected respiratory syncytial virus (RSV) or influenza. They placed Ezra on oxygen and ordered the requisite tests.

However, when Dr. Allareddy met with Ezra’s mom the next morning, something seemed off. “The presentation was more of a bronchiolitis, but the symptomatology reported by Ezra’s mom did not match,” Dr. Allareddy says. “I also observed that he had weak movement throughout his body. He was just lying there making feeble noises, not a good cry.” The hour-long conversation also revealed that the family had cleaned its garage a few days earlier. For Drs. Allareddy and Shein, that set off the alarm bells.

“That morning, we spoke with the neurology team, saying we had a patient with early symptoms of what looked like infant botulism,” Dr. Allareddy says. Although the extremely rare condition is perhaps best known for its link to contaminated food, most of the 80 to 110 annual cases in the U.S. are currently thought to result from ingestion of environmental dust containing spores of *Clostridium botulinum*.

Clinical suspicion was high, but the team needed more proof in order to secure the sole treatment for infant botulism – intravenous Botulinum immune globulin, or BabyBIG. Considered an orphan drug, BabyBIG is only available through the California Department of Public Health (CDPH) and comes with an approximately \$50,000 price tag. It also requires approval by a hospital’s chief financial officer.

Quickly, the team ruled out the conditions that could mimic botulism. “When Ezra came in and didn’t have obvious signs of infection, we were very concerned that he might be presenting with infantile spinal muscular atrophy,” says pediatric neurologist Nancy Bass, MD. However, a blood test and the rapid progression of his symptoms ruled that out. “That told us we were more in the world of a toxic exposure or infantile myasthenia,” she says. A bedside electromyogram (EMG) provided the key finding that was needed.

The team did not yet have confirmatory results from the stool test they’d initiated; Ezra’s reduced gastrointestinal motility and constipation had made securing a sample impossible for the first days of his hospitalization. But they contacted the CDPH anyway. Within 30 minutes, they had financial approval from the hospital. The BabyBIG arrived via FedEx the next morning.

After a three-week hospital stay – about two weeks in the PICU, including about a week on a ventilator – Ezra returned home. He has had two follow-up appointments with Dr. Bass and has now “graduated” back to the care of his UH Rainbow Babies & Children’s pediatrician.

“It really was a team success,” says Dr. Shein. “There were multiple intensivists, the neurologists, the infectious disease specialists, the technicians who did the EMG, the nurses, the respiratory therapists, each contributing his or her particular piece of the puzzle. If Ezra hadn’t gotten the treatment when he did, instead of being on the ventilator for one week or so, he may have been on for six weeks.”

For Dr. Bass, this case also represents a teachable moment for pediatricians. “If you come across a baby with acute low muscle tone and poor feeding, you may tend to think about an infection such as meningitis,” she says. “But if there’s a history of constipation within the last month, a light bulb should go off in your head that this could possibly be botulism.”

Contact any of the physicians in this article at [Peds.Innovations@UHhospitals.org](mailto:Peds.Innovations@UHhospitals.org).



**VEERAJALANDHAR ALLAREDDY, MD**

*Pediatric Critical Care, UH Rainbow Babies & Children’s Hospital  
Clinical Assistant Professor, Case Western Reserve University School of Medicine*



**STEVEN L. SHEIN, MD**

*Pediatric Critical Care, UH Rainbow Babies & Children’s Hospital  
Assistant Professor, Case Western Reserve University School of Medicine*



**NANCY BASS, MD**

*Pediatric Neurologist, UH Rainbow Babies & Children’s Hospital  
Associate Professor, Case Western Reserve University School of Medicine*

# a longitudinal look

## UH RAINBOW EXPERTS CONTINUE LONG-STANDING RESEARCH INTO INFANTS BORN EXTREMELY PREMATURE

Innovations in neonatology over the past three decades have changed the equation for families experiencing a preterm birth, with infants born prematurely today surviving at birth weights that would have been inconceivable just a few years ago. However, with this good news has come the realization that preterm birth often has lasting effects on a child's cognition, behavior and learning, especially for the child with more extreme prematurity.



"In the vast majority of cases, there are some early effects on the brain," says H. Gerry Taylor, PhD, a pediatric neuropsychologist at University Hospitals Rainbow Babies & Children's Hospital. "I've been interested in looking at how these effects manifest themselves as a child grows."

Dr. Taylor has been tracking neuropsychological outcomes in extremely premature/extremely low birth-weight (ELBW) infants since the 1980s. At the same time, neonatologist Maureen Hack, MB, ChB, has been tracking these infants' physical growth, health conditions and educational achievement, with cohorts dating back to 1977. Dr. Hack reported 20-year outcomes of a 1977 – 1979 cohort in *The New England Journal of Medicine* in 2002, noting that the educational disadvantages associated with very low birth weight appear to persist into young adulthood.

More recently, Dr. Taylor and Dr. Hack have followed a cohort of ELBW infants born between 2001 and 2003. They've found that these children have rates of cognitive deficits three to six times higher than that of their normal birth-weight peers. In addition, they've found that these kids tend to have lower academic achievement in kindergarten, higher rates of attention-deficit hyperactivity disorder (ADHD) and much higher rates of teacher-identified problems with attention, behavior self-regulation and social functioning.

Now, Dr. Taylor and Dr. Hack have completed the first study to include direct observations of how these children actually behave in a kindergarten classroom. Writing in the journal *Early Human Development* earlier this year, they report that ELBW children receive more attention from teachers and are more often off-task in the classroom, when compared with their normal birth-weight peers.

"This is evidence that the problems we see in the cognitive testing and the problems parents and teachers report in rating scales actually translate to how these children perform in the classroom," Dr. Taylor says. "It's not necessarily surprising, but it does point to the predictive value of cognitive testing. It also points to the need for more individual attention for these kids and the need for targeted special education strategies."

For their study, Dr. Taylor, Dr. Hack and colleagues observed 111 ELBW children and 110 normal birth-weight controls in the kindergarten classroom over a one-hour period. Observers were blind to each child's birth-weight status, with one observer assigned to one child at a time. Each observation minute was divided into three 20-second segments. During the first segment, the observers noted what the child was doing. During the second, they noted what the teacher was doing. During the last, they noted the activity of the classroom as a whole.



Results showed clear differences between the ELBW and normal birth-weight children, with effects most pronounced in the lowest birth-weight children. However, some classroom factors seemed to blunt the effect of birth weight. ELBW children functioned more effectively in the kindergarten classroom when the teacher was more experienced, when there was another adult present and when the class was small.

For Dr. Hack, these findings confirm the struggles that ELBW kids continue to have in meeting the demands of the classroom. However, she is quick to add that they don't necessarily apply to every ELBW child. "There are individual differences," she says. "Certainly we know some people do amazingly well."

"One thing you learn following these kids is just how resilient human beings are," Dr. Taylor adds. "Despite the odds and despite the severe insult experienced so early in life, some kids do absolutely fine."

Going forward, Dr. Taylor and Dr. Hack hope to learn more about the factors that may lead to these better outcomes. "There is some neuroplasticity or set of experiences that can make a difference," Dr. Taylor says. "We need to find out more about what those are so that we can promote better outcomes in everyone."

In the meantime, they hope their work leads to a better understanding of the services that are necessary for ELBW children to succeed, both from parents and from schools. "Our findings give the impetus for policy changes that would allow for more individual interventions for these children," Dr. Taylor says. "In addition, they show that neuropsychological findings are meaningful in predicting school behaviors."

For ELBW kids, Dr. Taylor recommends a rich diet of activities that build school readiness. "These kinds need lots of language stimulation, preschool experiences, socialization and help in developing executive function," he says. In addition, he recommends baseline neuropsychological testing by the time the child enters school. "Earlier recognition can lead to better understanding of their problems and a better understanding of the interventions they need."

Contact Dr. Taylor at [Peds.Innovations@UHhospitals.org](mailto:Peds.Innovations@UHhospitals.org).



**H. GERRY TAYLOR, PHD**

*Pediatric Neuropsychologist, UH  
Rainbow Babies & Children's Hospital  
Professor, Case Western Reserve  
University School of Medicine*



**MAUREEN HACK, MB, CHB**

*Professor Emeritus, Case Western  
Reserve University School of Medicine*

The studies referenced in this article were funded by grants from the National Institutes of Health to Case Western Reserve University School of Medicine.

**UH** Rainbow Babies & Children's Hospital is one of the first hospitals in the country to own and operate Solea CO2 laser technology, which gained approval from the U.S. Food and Drug Administration (FDA) in August 2013. The Solea laser is the first dental laser to receive FDA approval for ablation of both hard and soft tissue. UH Rainbow Babies & Children's Hospital owns two units; one is housed at the hospital and the other is part of Ronald McDonald Care Mobile, its mobile dental clinic that provides dental care to underserved children in northern Ohio.

"This technology is revolutionary for pediatric dental treatment," says Gerry Ferretti, DDS, Division Chief of Pediatric Dentistry at UH Rainbow Babies and Children's Hospital. "The laser is perfect for kids because it works quietly, quickly and without the lingering numbness of local anesthetic following a typical dental procedure. We think it will be especially helpful in treating children with special needs, who may have more anxiety about seeing a dentist."

**Pediatric dentistry patients at University Hospitals Rainbow Babies & Children's Hospital have access to a new, anesthesia- and pain-free option for hard and soft tissue ablation, thanks to a gift from a Cleveland-area philanthropist.**

Manufactured by Convergent Dental, the Solea laser uses an oxygen-18 isotope and other modifications to emit 9.3 microns, matching the peak absorption of the hydroxyapatite that makes up 90 percent of tooth enamel. This innovation allows the laser to vaporize tooth enamel. Another commercially available dental laser, the Waterlase manufactured by Biolase, vaporizes water particles in the target area of the tooth and then chips away at the weakened enamel. The Solea CO2 laser also offers a first-of-its-kind computer-aided preparation system, which leads to improved speed and

precision compared with previous dental lasers. For soft tissue in the oral cavity, the Solea laser can be used for incision, excision, vaporization, coagulation and hemostasis.

By all accounts, the Solea laser has been well-received, both by dentists and medical technology-watchers. The American Dental Association recognized it in 2014 with a Dr. Bicuspid.com Dental Excellence Award, and Popular Science magazine named it a "Best of What's New" product for 2014, one of just 100 tech products recognized. The Solea laser also was a gold award winner in the 2014 Medical Design Excellence Awards. Convergent Dental reports that 95 percent of Solea users perform dental procedures on soft and hard tissue with no anesthesia, leading to efficiency gains of between 25 and 40 percent. The laser's rapid pulses of green light – as many as 10,000 per second – have a numbing effect on dental tissue.

The development of the 9.3-micron CO2 dental laser was chronicled last year in the Journal of Laser Dentistry. The paper summarized 90 scientific reports published in the past 30 years on the basic science, tissue interactions, mechanisms of action and operational parameters of the laser on hard and soft tissue.

Pediatric dentists at UH Rainbow Babies & Children's Hospital are enthusiastic about the new tool. "We are excited to be one of the first hospitals in the country to use this technology," says Dr. Ferretti. "I believe this will truly change what it means to go to the dentist."

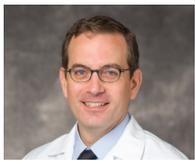
**Contact Dr. Ferretti at [Peds.Innovations@UHhospitals.org](mailto:Peds.Innovations@UHhospitals.org).**

## New Laser Technology Takes the Pain Out of Dentistry



**GERRY FERRETTI, DDS**

*Division Chief, Pediatric Dentistry,  
UH Rainbow Babies & Children's Hospital  
Anne Hunter Jenkins Endowed Master Clinician in Pediatric Dentistry and Orthodontics and  
Professor, Case Western Reserve University School of Medicine*

**PETER de BLANK, MD**

*Pediatric Neuro-Oncologist, Angie Fowler Adolescent & Young Adult Cancer Institute  
UH Rainbow Babies & Children's Hospital  
Assistant Professor, Case Western Reserve University School of Medicine*

**JOHN LETTERIO, MD**

*The Jane and Lee Seidman Chair in Pediatric Cancer Innovation  
Division Chief, Pediatric Hematology & Oncology  
Angie Fowler Adolescent & Young Adult Cancer Institute  
UH Rainbow Babies & Children's Hospital  
Professor, Case Western Reserve University School of Medicine*

**DUNCAN STEARNS, MD**

*Director, Pediatric Brain Tumor Program, Angie Fowler Adolescent & Young Adult Cancer Institute  
UH Rainbow Babies & Children's Hospital  
Assistant Professor, Case Western Reserve University School of Medicine*

**DATA-DRIVEN****Newly published report describes most up-to-date U.S. statistics for childhood brain and CNS tumors**

Infants and children who are diagnosed with brain and central nervous system (CNS) tumors tend to develop unique groups of tumors, as compared to adults with the same disease. This makes separate statistical reporting necessary to fully understand the extent of these tumors in these populations and survival after diagnosis, not only for clinicians and researchers, but also for patients and their families.

"We need to know how well we're doing – whether survival is improving over time, which tumors are lagging behind and which are showing a lot of progress," says Peter M. de Blank, MD, a pediatric neuro-oncologist at University Hospitals Rainbow Babies & Children's Hospital.

"These very specific statistics allow physicians to have the knowledge they need to answer questions families may have about their child's disease," adds Jill Barnholtz-Sloan, PhD, Associate Director for Bioinformatics at the Case Comprehensive Cancer Center at Case Western Reserve University.

"Most children's brain tumors are pretty rare, so to really get a sense of the epidemiology, large statistical analyses are necessary," says Duncan Stearns, MD, Director of the Pediatric Brain Tumor Program at UH Rainbow Babies & Children's Hospital. "A single institution will see maybe 50 or 100 cases a year, at a maximum. To get the big picture, you have to look across the whole country."

To address this need, a team of biostatisticians, brain tumor epidemiologists and pediatric neuro-oncology specialists from the Case Comprehensive Cancer Center, UH Rainbow Babies & Children's Hospital and other Ohio children's hospitals has produced a detailed statistical report on the current state of brain and CNS tumors in American infants and children through age 14. Produced with funding awarded to Case Western Reserve University School of Medicine from Alex's Lemonade Stand Foundation and cancer surveillance data from the Central Brain Tumor Registry of the United States (CBTRUS), the report contains the most up-to-date, population-based data currently available on primary childhood brain and CNS tumors, covering the years 2007 to 2011. The report was published earlier this year as a supplement to the journal *Neuro-Oncology*; Drs. de Blank, Barnholtz-Sloan and Stearns were among the co-authors.

The CBTRUS includes data from the National Program of Cancer Registries (NPCR) of the Centers for Disease Control and Prevention (CDC), as well as from the National Cancer Institute's (NCI) Surveillance, Epidemiology and End Results (SEER) program, covering 98 to 99 percent of all brain tumor diagnoses in the U.S. The Neuro-Oncology report on the pediatric sub-population includes incidence counts and rates of both malignant and non-malignant tumors by CNS site, histology, gender, age, race, ethnicity and geographical region. Mortality and relative survival rates, cross-tabulated with these variables, are also included.

Results of the analysis show that brain and CNS tumors remain the most common solid tumor and the most common cause of cancer death in infants and children through age 14, with little to no geographical variation. Although these findings are not surprising to pediatric oncologists, they are valuable all the same, they say.

"Our ability to understand and recognize trends in diagnosis and outcomes for brain tumors in this age group facilitates opportunities to identify key factors that may contribute to the development of disease," says pediatric oncologist John Letterio, MD, Division Chief of Pediatric Hematology-Oncology at UH Rainbow Babies & Children's Hospital, who was also a co-author of the Neuro-Oncology report. "It also informs our design and conduct of the clinical trials that will become increasingly important to improving survival rates for these patients."

"This work highlights the importance of NCI-designated comprehensive cancer centers as they bring together the resources and expertise needed to collaborate with their primary pediatric affiliates, like the Angie Fowler Adolescent & Young Adult Cancer Institute at UH Rainbow Babies & Children's Hospital," Dr. Letterio adds. "This partnership is necessary for us to bring the most advanced, technically demanding therapies to bear on cancers like brain tumors, which continue to be the leading cause of cancer-related mortality in children."

Contact Drs. de Blank, Stearns or Letterio at [Peds.Innovations@UHhospitals.org](mailto:Peds.Innovations@UHhospitals.org).

## Adenotonsillectomy for Kids with Obstructive Sleep Apnea Syndrome: **UNDERSTANDING OUTCOMES**

When the first results of the national Childhood Adenotonsillectomy Trial (CHAT) appeared in *The New England Journal of Medicine* in June 2013, there was much attention on what the investigators didn't find. Although the investigators thought they would see group differences for changes in attention and executive function among children with obstructive sleep apnea syndrome (OSAS) who had surgery, compared with those managed with watchful waiting, none were seen. But this was only part of the story.

"Many other health outcomes were very different between the two groups," says Carol L. Rosen, MD, a co-author of the NEJM paper and a pediatric pulmonologist and sleep medicine specialist at University Hospitals Rainbow Babies & Children's Hospital. "There were greater improvements in parent-reported sleep apnea symptoms, other behaviors and daytime functioning, quality of life and overnight sleep study among kids who had the surgery."

Two recent studies in the journal *Pediatrics*, also co-authored by Dr. Rosen, shed new light on how adenotonsillectomy affects kids with OSAS. The CHAT investigators again found greater improvements in multiple quality-of-life measures among the kids treated surgically, compared with those managed with watchful waiting – an outcome very important to families. However, a second study highlighted a potential downside: increased weight gain, especially among kids who were already overweight. More than half of overweight kids with OSAS who had surgery became obese during the seven-month follow-up period of the study.

"These findings tell us that caring for children after adenotonsillectomy for OSAS is multifaceted," Dr. Rosen says. With today's obesity epidemic in youth, you need to be prepared for weight gain and make a plan to address it."

In a third Pediatrics study, Dr. Rosen and the CHAT investigators compared a simple OSAS symptom questionnaire called the Pediatric Sleep Questionnaire (PSQ) to overnight sleep testing to determine which best predicts improvements in daytime functioning after adenotonsillectomy. Results showed that the PSQ, designed by CHAT investigator Ronald D. Chervin, MD, was better at predicting behavioral changes after surgery than sleep study data. "This study confirms the great value in a careful, traditional, office-based clinical assessment," Dr. Rosen says. "This second wave of papers from the CHAT study highlights the importance of looking at health outcomes after adenotonsillectomy from multiple points of view."

**Contact Dr. Rosen at [Peds.Innovations@UHhospitals.org](mailto:Peds.Innovations@UHhospitals.org).**



**CAROL L. ROSEN, MD**

*J.S. Rube Endowed Chair  
in Pediatric Sleep Medicine  
Medical Director, Pediatric Sleep Center,  
UH Rainbow Babies & Children's Hospital  
Professor, Case Western Reserve University  
School of Medicine*

The studies referenced in this article were funded by grants from the National Institutes of Health to Case Western Reserve University School of Medicine.



University Hospitals Case Medical Center and Case Western Reserve University School of Medicine are consistently recognized as two of the premiere institutions in the nation, according to U.S. News & World Report.

Innovations in Pediatrics Spring 2015

Contributors: Veera Allareddy, MD; Nancy Bass, MD; Peter de Blank, MD; Gerry Ferretti, DDS; Maureen Hack, MB, ChB; John Letterio, MD; Carol L. Rosen, MD; Steven L. Shein, MD; David Speicher, MD; Duncan Stearns, MD; H. Gerry Taylor, PhD

Writer: Kelly Kershner Designer: Heather Sandrey

Marketing Managers: Tia Trivison, Kellie Crowe

Innovations in Pediatrics is published by University Hospitals for physicians and should be relied upon for medical education purposes only. It does not provide a complete overview of the topics covered and should not replace the independent judgment of a physician about the appropriateness or risks of a procedure for a given patient.

UHhospitals.org © 2015 University Hospitals in Cleveland, Ohio. All rights reserved. Contents of this publication may not be reproduced without the express written consent of University Hospitals.