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Pediatrics

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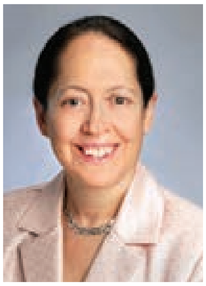
Barbara J. Stoll, M.D.

Healthcare for the Children of Greater Atlanta

Improving the Lives of Our Community's Most Valuable Resource

We are delighted that this issue of *Atlanta Medicine* focuses on children, our most precious resource. Georgia has 2.7 million children, representing approximately 28 percent of the state's overall population (www.statehealthfacts.org). Atlanta has both the sixth largest pediatric population in the country and the second largest projected growth among major metropolitan areas in the United States. Georgia's children are at significant risk — more than 300,000 of Georgia's children are uninsured and nearly half live in families below 200 percent of the federal poverty level (National Center for Children in Poverty www.nccp.org/GA_profile_6.html).

The current fragile economy is taking a dramatic toll on families across the entire socioeconomic spectrum. While low parental education and socioeconomic status have traditionally impacted poverty the most, we are now seeing increased poverty among even the more educated families, with nearly a third of those with degrees beyond high school representing families with low incomes.

These alarming statistics parallel adverse health outcomes. Georgia has the second highest rate of childhood obesity and one of the highest rates of asthma in the country. Compared to the national average, Georgia has higher rates of infant mortality (8.1 vs. 6.8 per 1,000 live births), teen deaths (73 vs. 62 per 100,000 populations), and childhood obesity (37.3 vs. 31.6 percent). Despite health needs, Georgia's per capita spending on health lags behind the national average ($4,600 vs. $5,300 for 2008-2009) (www.statehealthfacts.org).

This issue of *Atlanta Medicine* reflects the growing partnership between Emory's Department of Pediatrics and Children's Healthcare of Atlanta. Emory and Children's, together with other institutions in Atlanta (including Morehouse School of Medicine, Georgia Tech, the Centers for Disease Control and Prevention and others), are working to address the health needs of Atlanta's children.

We have tried to give the reader an introduction to some of the exciting and innovative pediatric initiatives in Atlanta. Articles in this issue report on new ways to train medical students and residents (Simulation in Pediatric Medical Education); new advances in science and clinical care (What's New at Children's Healthcare of Atlanta, Pediatric Neuro-Oncology, Traumatic Brain Injury Care, Updates on Newborn Screening and Immune Disorders, Coordination of Diabetic Care); common and emergent problems (Common Pediatric Emergencies); Atlanta in the broader context of national healthcare issues (Healthcare Reform and Access to Care); and Atlanta as a hub for global health activities (Global Child Health). We are grateful to our contributors, national and local leaders in clinical care delivery, education, research and child advocacy.

We dedicate this issue of *Atlanta Medicine* to our colleague, Dr. Paul Fernhoff. Dr. Fernhoff's recent and untimely death is an immeasurable loss to the children and families he served. A nationally recognized pediatric geneticist and ethicist, Dr. Fernhoff dedicated more than 35 years to this community—caring for patients with complex disorders, counseling families, educating the next generation of pediatricians and geneticists, conducting research, being engaged in advocacy for children with genetic disorders and working to enhance newborn screening in our state and the nation. ■

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Healthcare Reform

What It Means for Georgia's Children and Their Families

The Affordable Care Act (ACA) has ushered in a new era for healthcare reform in the United States. Although the roadmap for the future is not entirely clear, pediatricians and other healthcare providers for children are hopeful that changes will benefit both the children and families we serve and the providers of care.

Throughout the healthcare reform process, the American Academy of Pediatrics has focused on three fundamental priorities for children, pediatricians, other healthcare providers and families:

- Access to covered services through appropriate payment rates and workforce improvements;
- Age-appropriate benefits in a medical home; and
- Health insurance coverage for all children in the United States.

The following is a summary of what healthcare reform has meant so far to children in Georgia. Reforms that affect children and young adults that have already gone into effect include:

- Children less than 19 years of age with pre-existing health conditions cannot be denied coverage by new and existing group plans.
- Young adults can stay on their parent's health insurance until they turn 26 years of age.
- There are now definitive standards for pediatric well-child and preventive care.
- Preventive coverage is provided with no co-pays on all new plans issued after September 2010.
- Insurers can no longer drop coverage for children when they become ill.
- Insurance companies, after September 2010, have been prohibited from imposing lifetime dollar limits on essential benefits such as hospital stays.
- An external review process for consumers appealing claims is mandated with new plans after September 2010.

These provisions affect all children in the United States, including those in Georgia. A helpful timeline of the implementation of the Affordable Care Act (ACA) is on the HealthCare.gov website www.healthcare.gov/law/timeline). It highlights other important changes through 2018 that will become law and will affect young patients and their families. This is assuming the timeline continues as initially planned in the ACA.

As of October 2011, a new open enrollment period for families in the State Health Benefit Program (SHBP) for state employees in Georgia went into effect. Families with income levels up to 235 percent of the Federal Poverty Level – which equates to a household income of about $52,500 for a family of four – will be eligible to enroll their children in PeachCare, Georgia's federally subsidized version of a State Children's Health Insurance Program (SCHIP). It is estimated by state officials that 80,000 children now in the state's employee health plan may be eligible for PeachCare and that perhaps more than half of those eligible will enroll in PeachCare (SCHIP), dropping their SHBP coverage.

This potential shift from SHBP to SCHIP has raised concerns among pediatricians and other pediatric healthcare providers. Access to primary care providers, pediatric subspecialists, special therapies and medications have been and continue to be limited in the PeachCare program as compared to commercial insurance plans.

The move to SCHIP may mean cuts in reimbursement to their practices of up to 40 percent from commercial insurance rates, which SHBP now pays. Additionally, several other states in the U.S. are taking advantage of the ACA provisions of additional federal matching dollars in order to increase enrollment of eligible children to the Medicaid/SCHIP programs in their states. The future will have to unfold before we truly know how this will impact the patients and their physicians.

One of the more notable provisions in the ACA is the *Partnership for Patients* initiative launched in April 2011 by the U.S. Department of Health and Human Services (HHS). This will fund efforts to decrease patient injuries, such as hospital-acquired infections, and lower the readmission rates of patients recently discharged from the hospital. Also, in 2012, Georgia will be required to implement a list of preventable conditions in hospitals that will not be paid by Medicaid. These changes will lead to improved patient safety and decreased costs.

The State Exchanges that will provide an additional avenue for families to purchase affordable health insurance will begin in January 2014. Much preparation needs to occur for Georgia to be ready. State plans will be reviewed and approved by HHS in early 2013 so open enrollment can begin in October of that year. 2012 becomes a very important and busy year as the state must pass enabling legislation and conduct procurement activities.

As both federal and state level rules are put into place, pediatricians will need to play an active role in assuring that the needs and welfare of children are addressed. Although legal challenges have been brought to various provisions of the ACA, the State should move forward with the implementation process as required by current law.

One of the most important aspects of the entire ACA is the way Medicaid will be managed in the coming years by both the federal government and the state. The normalization of Medicaid payments with Medicare for certain primary care services in 2013 and 2014 may give us an opportunity to provide better access to medical homes for children in the Medicaid and PeachCare programs for a period of time. Yet there is no doubt insufficient funding for public insurance programs will continue to stress our ability to provide all children with needed care.

The future of healthcare is firmly mired in the political climate of Washington. Legal and funding challenges persist. We certainly do not know exactly how the process will evolve. As pediatricians from the Georgia Chapter of the American Academy of Pediatrics and other pediatric healthcare providers, we must all advocate to optimize the healthcare and healthcare finance systems for those we all consider to be Georgia's most valuable natural resource … its children. ■

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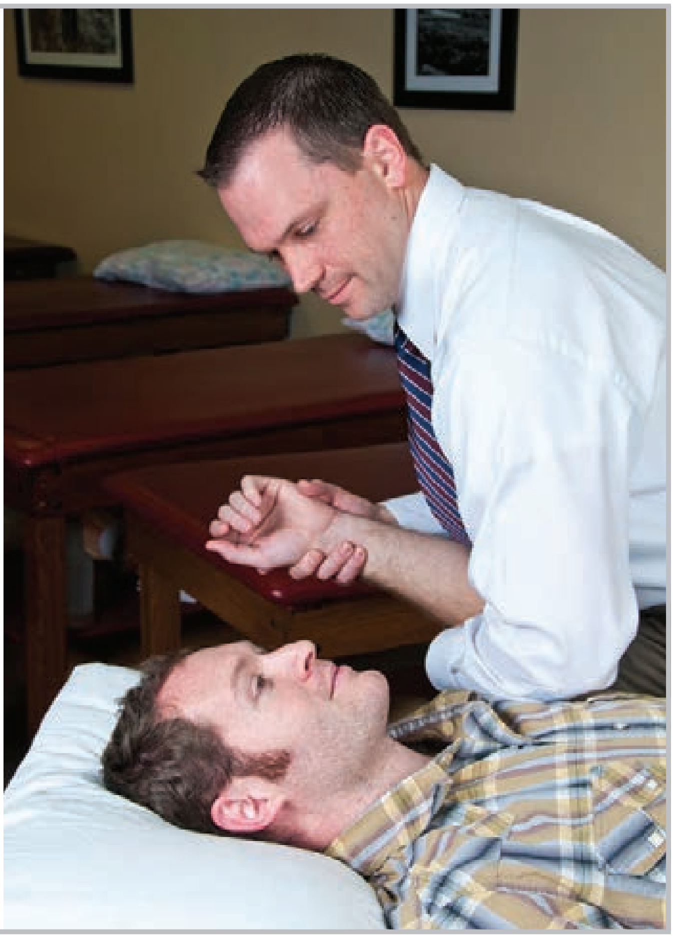


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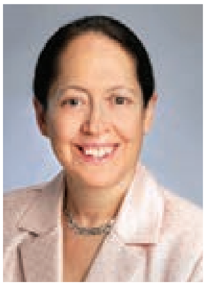
Barbara J. Stoll, M.D.

What's New at Children's Healthcare of Atlanta

Kristina Gentry, a 16 year old from Warner Robbins, has been doing nothing but hurting for the past year. She is battling a painful chronic disorder called Crohn's disease that causes her digestive tract to become inflamed and infected. She tried countless medications, even experimental drugs, but nothing worked. At one point the teen couldn't even eat.

Kristina's doctors recommended one last radical treatment option. If she agreed, she would become the first pediatric patient at Children's Healthcare of Atlanta, maybe the first in the entire country, to undergo a bone marrow transplant for Crohn's disease. Doctors wanted to use chemotherapy to wipe out Kristina's immune system, then reboot it using her own stem cells. Kristina researched the procedure on the Internet and wanted to do it.

Children's and Emory pediatric gastroenterologist Subra Kugathasan, M.D., said the teen had about a five percent chance of a life-threatening complication, but the Crohn's disease, too, was dangerous. According to Dr. Kugathasan, he basically reset her immune system just like a newborn baby. Today, Kristina shows no sign of Crohn's disease. She's back to her music lessons and is looking forward to going to college, getting a good job and, well, growing up.

If not for the research, the innovation, the intellect of top physicians and researchers, children like Kristina would forever live in pain and even fear of death when diseases threaten their young lives.

Fortunately, pediatric research is thriving and expanding in Atlanta through a unique multi-institutional initiative including: Children's Healthcare of Atlanta, Emory University School of Medicine, Georgia Institute of Technology and Morehouse School of Medicine.

Building for the Future

In a collaborative effort to further innovations around pediatric research, Children's and Emory recently broke ground on a new health sciences research building that will allow for the development of an even more robust pediatric research program. The new five-story building will encompass 200,000 square feet, with four stories above ground.

More than half of the new facility will focus on pediatric research through the Emory-Children's Pediatric Research Center, a partnership between Emory and Children's. Fourteen key priority centers have been identified as part of this partnership. They are: hematology and oncology through the Aflac Cancer Center and Blood Disorders Service, immunology and vaccines, transplant immunology and immune therapeutics, pediatric healthcare technology innovation, cystic fibrosis, developmental lung biology, endothelial biology, cardiovascular biology, drug discovery, autism, neurosciences, nanomedicine, outcomes research and public health, and clinical and translational research. Paul Spearman, M.D., chief research officer at Children's and vice chair for research in the Emory University Department of Pediatrics, coordinates research activities of the collaborative center.

The building will include a two-story working bridge connecting it to the Emory-Children's Center. The bridge will be named in memory of George W. Brumley Jr., M.D., who served as Chair of the Department of Pediatrics at Emory University, Medical Director at Children's at

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Egleston from 1981 to 1995, and later went on to develop the Whitefoord Community Program.

The new facility will provide the necessary infrastructure for investigators conducting research to improve the quality of care and develop better treatments for Georgia's pediatric population. This project has implications for the city of Atlanta as a growing research community, building on collaborations with Georgia Tech, Morehouse School of Medicine and others.

What's New

This year, Children's, Emory and Georgia Tech premiered the first Center for Pediatric Nanomedicine in the nation, believed to be the first center of its kind in the world. Nanotechnology is the science of manipulating materials, structures and devices at the molecular level. Because it can be applied to many pediatric diseases and conditions, nanomedicine has the potential to profoundly improve – if not completely revolutionize – the diagnosis, treatment, care and ultimate cure of childhood diseases and conditions. The center's researchers are working to engineer effective therapeutic interventions. Specific focus areas for this center include: pediatric heart disease and thrombosis, infectious diseases, cancer, sickle cell disease and cystic fibrosis.

The National Heart Lung and Blood Institute recently selected Emory and Children's as a key site for the Pediatric Heart Network, a cooperative network of pediatric cardiovascular clinical research centers. This $19.6-million National Institutes of Health (NIH) funded program supports collaboration among pediatric cardiologists across the United States and Canada to conduct studies in children with congenital or acquired heart disease with the ultimate aim of improving care and improving outcome for these children.

Researchers in Neonatal-Perinatal Medicine were recently refunded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) for continued participation in the NICHD Neonatal Research Network, a consortium of 18 academic centers that conducts studies on high-risk and critically ill newborn infants.

Continuously funded by NIH since 1991, our investigators have participated in numerous studies over the past two decades that have changed how neonatologists care for premature and other high-risk infants. A recent example is the use of whole body hypothermia to improve outcome of severely ill newborns with perinatal hypoxic-ischemic injury – a treatment strategy that started as a Network multicenter research study and is now routine care in our nurseries.

In another study, Children's and Emory are collaborating with Georgia Tech to design a new way to treat invasive brain tumors by capturing the migrating cells that spread the disease. The research is funded by a EUREKA grant from the NIH. The EUREKA – Exceptional, Unconventional Research Enabling Knowledge Acceleration – program helps scientists test new, unconventional ideas or tackle major methodological or technical challenges.

Medulloblastoma is the most common malignant brain tumor seen in children, but unfortunately the five-year survival rates for children with this cancer only range from 50 percent to 70 percent, and the majority of survivors have a reduced quality of life as a result of treatment-related toxicities. This EUREKA grant aims to address the urgent need to develop therapies to safely treat invasive medulloblastomas in children.

The current treatment involves surgery followed by radiation therapy to the entire brain and spine and up to one year of intensive intravenous chemotherapy. However, radiation is often delayed or omitted altogether in young children due to its debilitating long-term side effects on the developing central nervous system.

With this research, the hope is to deliver the tumor to the drug by directing tumor cells to a specially engineered gel that can be removed or designed to kill the cells. The researchers plan to design a polymer thin film system that will include topographical and biochemical cues similar to those that guide the initial brain tumor invasion. The thin films will be rolled up and deployed with minimally invasive catheters. Because neural tissue will not be suctioned and the films are very thin, there should be minimal tissue and tumor disruption.

If successful, this approach would identify a new and innovative way to treat pediatric medulloblastomas and has the potential to open a new avenue for the treatment of other invasive solid tumors, such as brain stem tumors. These cancers are incurable because they are located in an inoperable region and/or they are resistant or inaccessible to the delivery of chemotherapy agents.

Research studies are the building blocks of medical breakthroughs – breakthroughs that change the lives of children. These are just a few of the many efforts fostering an environment of curiosity and innovation in the Atlanta research community. Together, Children's, Emory, Georgia Tech and Morehouse seek to answer the most challenging childhood medical conditions through teaching and research. By constantly developing new techniques, treatments and cures, we are committed to advancing pediatric research and medicine. ■

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Providing Safe, Effective and Efficient Care to Georgia's Children

In 1999, the Institute of Medicine (IOM) released its report, "To Err Is Human," which noted that medical errors in the United States contribute to 44,000 to 98,000 deaths per year at a total cost of $17-$29 billion.[1] That report marked the beginning of a wave of patient safety and quality initiatives throughout our nation's hospitals. Shortly thereafter, Children's Healthcare of Atlanta (Children's) developed its first quality strategic plan.

Safe Care: One Is Not Zero

For the past decade, Children's has continued to invest heavily in its Quality and Patient Safety program aimed at eliminating preventable harm to our patients. While recognizing that providing medical care to sick and injured children is a complex task prone to error, Children's has adopted the motto, "One Is Not Zero," indicating that even one child injured due to a medical error is unacceptable.

A major focus of patient safety programs around the country has been the early recognition of deteriorating patients. Children's approached this by adopting the Pediatric Early Warning Score (PEWS), which is used as a "fifth vital sign," and implementing Rapid Response Teams (RRTs), which are teams of highly trained nurses and respiratory therapists who work in critical care areas and are immediately available to help patients on the general care floors. By educating frontline staff regarding the early signs of shock and giving them tools such as the PEWS score and Rapid Response Teams, Children's has dramatically decreased the number of acute emergencies, including cardiorespiratory arrests ("Code Blues") occurring outside the intensive care units.

The ordering, dispensing and administration of medications is another complex process that is highly prone to error. To mitigate these risks, Children's has undertaken a number of strategies including investing in a computerized order entry system and "smart pump" technology; however, at the end of the day it is the frontline nurse who has the greatest role in preventing medication errors.

Children's has therefore organized a team of frontline staff that meets regularly to strategize on how to reduce medication errors. This medication safety team recently rolled out the "MedZone" campaign, which is aimed at heightening awareness around how distractions and interruptions contribute to errors. The result of these efforts has been a reduction of 69 percent in serious medication errors since 2007.

Infections that are acquired after a patient enters a healthcare setting are another cause of potentially avoidable morbidity and mortality. These infections can range from minor upper respiratory infections to life-threatening infections such as blood stream infections, ventilator-associated pneumonia and surgical site infections.

To reduce the risk to our patients, Children's has developed an infection prevention team that includes infection control practitioners, industrial hygienists and infectious disease physicians. Again, engagement with frontline staff is critical. A number of communication campaigns have been launched including "FoamUP," an award-winning physician and staff-driven effort aimed at achieving 100 percent hand hygiene compliance. The results of these efforts have been impressive: hand hygiene compliance above 95 percent, a 77 percent decrease in central line associated blood stream infections, and near elimination of ventilator-associated pneumonia.

Creating a Safe and Just Culture

It has been said that "culture eats process for lunch." While healthcare systems strive to perfect processes and policies, at the end of the day it is the culture of the staff that has the greatest impact on quality and safety. In a safety-focused culture, staff feel free to report errors and identify opportunities for improvement. Yet there is a longstanding tradition in healthcare of expecting perfection from nurses and physicians, and when good people with good intentions make human errors, they tend to be punished severely. David Marx, a system safety engineer and juris doctor in law, has described this phenomenon as "whacking the mole."

Recognizing that a safe culture depends on open and honest communication, Children's has adopted "Just Culture" principles, which recognize three conditions that lead to errors: human errors, risky behaviors and reckless behaviors.

According to this philosophy, the response to error must be in line with the type of behavior that led to the error in the first place. There must be no tolerance for reckless behavior, but conversely, when well-intentioned staff make "human errors," it is incumbent upon the system to fix the processes that lead to that error and to remember to console the people involved. Children's believes that these principles improve care by promoting open communication while still creating accountability, ultimately encouraging safe behavioral choices among staff.

Effective Care

Effective care is one of the IOM's six important dimensions of quality.[2] Effective care refers to services that are of proven value and have no significant tradeoffs. These services are backed by medical theory and strong evidence of efficacy determined via clinical research. Studies show that both in adults and in pediatrics, on average, patients receive only about half of the recommended basic elements of effective care.[3,4] The underutilization of effective care represents a wasted opportunity to prevent morbidity and mortality for a variety of common conditions in both children and adults.

Over the last decade or so, the Quality Improvement (QI) movement has focused heavily on the delivery of effective care. At Children's, clinicians are engaged in developing and using evidence-based clinical guidelines to promote the use of therapies and interventions for common conditions based on scientific evidence.

For example, the Emergency Departments (EDs) have guidelines and protocols for the management of fever, acute gastroenteritis, asthma, bronchiolitis, head injury, sickle cell with pain/fever and many others. Given the large volume of patients seen in the EDs at Children's (about 200,000 annually), use of uniform evidence-based guidelines can have significant impact. Children's physicians are also actively involved in disseminating and educating practitioners taking care of children around the metro area and the state of Georgia on these guidelines so they can be armed with the latest approaches to managing common pediatric illnesses.

Efficient Care

Not only does medical care need to be effective, it also has to be efficient. In other words, it should be delivered without waste – of resources, equipment, supplies and time. While the QI movement has made significant strides in patient safety and delivery of effective care, efficiency has lagged behind.

One reason for this is that waste in healthcare is sometimes difficult to define. Children's has adopted the Lean philosophy for reducing waste and non-value-added activity from clinical processes. Clinical teams regularly attend Lean workshops run by *Process Improvement* specialists in the Quality Department – they then go back to their own clinical units to see where waste exists and how to eliminate it.

Another important area of inefficiency in medicine is the overuse of resources. While evidence-based guidelines help with effective care, there is often little evidence in medical texts or consensus amongst experts on when to hospitalize, when to admit to intensive care, and for most conditions, when to order diagnostic or imaging tests. This results in wide variations in the practice patterns of clinicians, which do not improve outcomes, but do often add to waste of resources and medical costs.

Since 2009, Children's has undertaken a system-wide initiative to reduce practice variation by creating physician-led, multi-disciplinary teams for an in-depth look at the patterns of care delivery for a variety of diagnoses across its three campuses. These initiatives have not only produced reductions in length of stay and resource use, the consistency of care is also likely to improve safety.

Looking forward …

As per capita healthcare costs continue to rise, healthcare reform will demand that hospitals are able to demonstrate value. Value in healthcare can be defined as the ratio of quality of care to the cost of providing that care. We can increase the value of healthcare delivered to patients by improving outcomes at similar costs or by reducing costs involved in patients' care while maintaining the quality of outcomes.[5] As one of the largest providers of pediatric care in the country, Children's is committed to providing the highest quality care at the lowest possible costs by setting the benchmark for safe, effective and efficient pediatric care. ■

$$\text{Value} = \frac{\text{Quality}}{\text{Cost}}$$

$$\text{Quality} = \text{Outcomes} + \text{Safety} + \text{Service}$$

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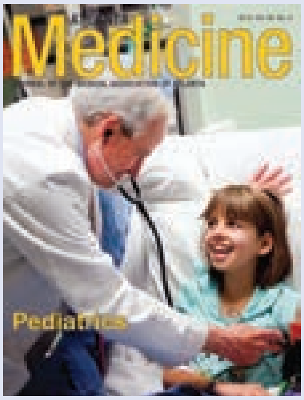
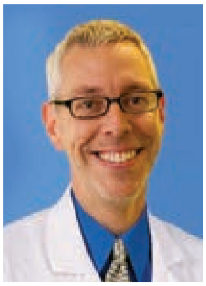


Pictured is Dr. Joseph Snitzer III, who has been a senior member of the Emory faculty for more than 25 years and is a pioneer in pediatric hospital medicine; he founded the Hospitalist Program at Egleston in 1983. He is known for being a master diagnostician, a mesmerizing teacher and a caring human being. He understands and actively teaches both the science and the art of pediatric medicine to learners at all stages, sharing "clinical pearls" with his students. Experienced through years of private office practice in the Atlanta area, Dr. Snitzer understands childhood diseases as they impact families and practices. Many pediatricians credit Dr. Snitzer for his central role in the success of many private practices in the area — he's helped with everything from consulting on cases to helping staff offices with talented physicians. He is alongside a typical patient for whom he always bring a smile!

Dolly Aguilera, M.D.



Tobey MacDonald, M.D.

Management and Advances in Pediatric Brain Tumor Care

Every year, approximately 3,000 children in the United States are diagnosed with a central nervous system (CNS) tumor of the brain or spinal cord. Pediatric CNS tumors can occur at any age but differ from the adult counterparts in terms of tumor types, treatments used, response and tolerance to treatment (young children typically tolerate therapy better than adults).

Parents frequently ask, *"Why did my child get a brain tumor?"* Although there are some well established familial and genetic associations, such as neurofibromatosis and tuberosclerosis among others, the vast majority of CNS tumors have no known cause. Multiple studies, including one of cell phone use, have failed to show a valid causal relationship between environmental factors and childhood brain tumors with the exception of exposure to ionizing radiation.

The symptoms of a CNS tumor depend on the size and location of the tumor. The most common symptoms are those related to an increase in intracranial pressure (ICP) due to a blockage in the flow of the cerebrospinal fluid (CSF). The symptoms of elevated ICP include headache and vomiting. Excessive lethargy or difficulty arousing from sleep are advanced signs of impending herniation and coma. An inability to abduct one eye out laterally can also be a sign of increased ICP. Papilledema, observed by fundoscopic examination, is indicative of increased ICP. Other common symptoms include seizures, weakness or paralysis, changes in vision or speech, and disturbances in balance and coordination.

Spinal cord tumors may cause bowel and bladder dysfunction. Tumor involvement of the hypothalamus or pituitary can lead to hormonal imbalances or can manifest as defects in the visual fields. Tumors of the brainstem present with multiple cranial nerve deficits. Overall, the symptoms of a brain tumor tend to be vague and non-specific, often mimicking a viral illness but lacking a fever. Thus, a high level of suspicion by healthcare providers is important.

To establish the diagnosis of a CNS tumor after a suggestive history and physical exam, the most rapid test is a head CT, which is 96 percent to 98 percent sensitive for the detection of a brain tumor and can quickly determine whether there is increased ICP, bleeding, bony erosions or some other pathology. For any tumor detected by CT or in the case of a suspicious clinical history, an MRI of the brain is warranted to confirm the diagnosis and better delineate the anatomy in preparation for surgical intervention. For suspected spinal cord tumors, MRI is the preferred initial imaging. A lumbar puncture may be warranted to determine whether there is metastatic spread, or in the case of mid-line tumors, to evaluate for CSF tumor markers.

For a definitive diagnosis to determine the course of treatment, the next step is a biopsy or surgical removal of the tumor by the neurosurgeon. With very few exceptions, this is the only way to know the precise tumor type and accurately predict outcome.

A benign tumor does not metastasize and is typically curative by surgery alone. In contrast to that seen in adults, the majority of CNS tumors in children are benign. Unfortunately, some tumors are located in critical areas that are impossible for the neurosurgeon to remove without causing significant morbidity. These areas include the visual pathways, brainstem and deep central regions of the brain. Benign CNS tumors in these locations can cause life-long debilitating neurologic impairment, even death, and as such are typically treated with chemotherapy or radiation.

Malignant tumors contain cancer cells, are usually fast growing and invade surrounding tissue and have the capacity to metastasize. However, spread outside the CNS is rare. Because of the tendency to recur, malignant tumors are typically treated with radiation, with or without chemotherapy, irrespective of the extent of surgical removal.

The three most common types of childhood CNS tumors are:

Astrocytomas, classified as grade I-IV based on the presence of aggressive features, IV being the most aggressive. *Juvenile pilocytic astrocytoma* (JPA, grade I) is the most common childhood brain tumor. *Diffuse fibrillary astrocytoma* (grade II) is more commonly seen in adults than children. *Anaplastic astrocytoma* (grade III) and *glioblastoma multiforme* (GBM, grade IV) share a similarly poor outcome and are typically treated in the same manner as the adult counterpart. Brainstem gliomas occur almost exclusively in young children and can be diffuse within the pons, a *diffuse intrinsic pontine glioma* (DIPG), or focal. DIPG usually begin as grade II but ultimately progress to grade IV.

Medulloblastoma, which arises in the cerebellum, has the greatest propensity to disseminate and is the most common malignant brain tumor in children.

Ependymomas are derived from cells lining the CNS ventricles, most commonly the floor of the 4th ventricle.

Together, these three tumor types make up more than 90 percent of all brain and spinal cord tumors seen in children.

Treatment is determined by the tumor's type, genetics and location as well as the patient's age and overall health. For grade I and II benign astrocytomas, surgical resection alone is curative in more than 95 percent of cases. Radiation treatment or chemotherapy is reserved for inoperable or recurrent benign astrocytomas. Radiation therapy is administered for all malignant astrocytomas, including DIPG, and almost all ependymomas, irrespective of the degree of surgical removal.

Medulloblastomas are treated with a combination of radiation and chemotherapy after initial surgical removal. For very young children in whom radiation may be considered too harmful to the developing CNS, alternative approaches, including high-dose chemotherapy with stem cell rescue, are being investigated. The neuro-oncologist will determine which treatment will provide the most benefit. Monitoring neuro-cognitive development, hearing and endocrinologic function are important parts of the care, especially for young children and those receiving whole-brain or large-field irradiation.

For long-term survivors, continued follow up by a neuro-oncology team is necessary to monitor for late effects of treatment including infertility, growth and secondary tumors or cancers. Rehabilitation to regain motor skills and muscle strength may be required. Speech therapists and physical and occupational therapists play an active role in the rehabilitation process.

At Children's Healthcare of Atlanta (CHOA), we care for more than 100 children annually who have a newly diagnosed brain or spinal cord tumor, making CHOA one of the largest centers in the country specializing in the treatment of childhood CNS tumors. We also have one of the largest multidisciplinary teams dedicated to the care of children with brain and spinal cord tumors, consisting of 25 physicians and other healthcare staff, including five pediatric neurosurgeons and four pediatric neuro-oncologists in addition to on-site pediatric-focused radiation oncology, neuro-radiology, neuro-pathology, neuro-psychology, endocrinology, survivor-late effects clinic and inpatient rehabilitation. We also are one of a few centers to have *intraoperative MRI*, a tool that allows the neurosurgeon to determine whether the entire tumor has been removed or not prior to completing surgery.

In accordance with our size and experience, CHOA continues to lead the way nationally in the development of innovative treatments for children with CNS tumors. We are an active member of the Children's Oncology Group (COG), an international consortium of more than 200 medical centers that is supported by the National Institutes of Health (NIH) to implement clinical studies aimed at improving outcomes for children with cancer. Most recently, Emory faculty in the Aflac Cancer Center and Blood Disorders service at CHOA joined 23 other U.S. centers in the COG Phase I consortium, a highly select group of centers identified as having the greatest expertise and ability to conduct clinical trials of the most cutting-edge therapeutics available for children.

Additionally, in partnership with pharmaceutical agencies, multi-institutional groups and other consortia, we are now able to offer a number of treatments that are only available at a handful of centers worldwide. This means that children of Georgia and the neighboring Southeast will have direct access to the most innovative clinical trials available anywhere.

The following list highlights a few examples of our latest clinical and scientific research that is in addition to all of the current COG and COG Phase I clinical trials:

Clinical trial of the Novartis oral drug LDE225 for the treatment of relapsed medulloblastoma and other tumors that are associated with a tumor growth-promoting pathway known as sonic hedgehog (1 of only 4 U.S. centers with trial available)

Clinical trial of injectable PolyICLC immunotherapy for recurrent and refractory benign astrocytomas (1 of only 2 U.S. centers with open trial)

Clinical trial of oral Tarceva for relapsed ependymoma

Clinical trial of Cetuximab with radiation for the treatment of malignant astrocytoma and DIPG

Tumor vaccine-based trial in development for treatment of malignant astrocytoma and DIPG

NIH awarded highly competitive EUREKA grant to study, in collaboration with the Georgia Institute of Technology, a method to induce tumor cells out of the brain through minimally invasive nano-catheters

NIH funded research to study, in collaboration with Emory University and Winship Cancer Institute, novel therapeutics, medulloblastoma cancer stem cells and genetic control of metastasis

At CHOA, the care of children with CNS tumors is in the hands of a multidisciplinary team that provides state-of-the-art care by conducting research to elucidate mechanisms and understanding of cancer by improving outcomes and reducing unfavorable consequences of the treatment for children in the state of Georgia and the United States. ■

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Traumatic Brain Injury

An Overview of the Journey Towards "Healed"

Traumatic Brain Injury (TBI) is the most common cause of acquired disability in children, but the presentation varies from exceptionally mild to catastrophic. Concussions are the mildest form of traumatic brain injury. More devastating injuries resulting in bleeding in the brain, seizures and/or admission to an intensive care unit, or even death are seen in the most severe cases of TBI.

The most common cause of TBI varies based on the age group. There are three primary categories: pre-school aged (zero to four years old), school aged (five to 14 years old), and teen/young adult (15 to 17 years old). The highest incidences are in the pre-school age group and in the teen/young adult group.

The most common etiology of severe injury in pre-school children, especially infants, is non-accidental trauma. In school-age children, falls and motor vehicle collisions (MVCs) are the most common causes. Teens and young adults are also most likely to be injured in MVCs. Sport-related injuries represent a very small percentage of the total number of serious traumatic brain injuries, but they receive substantial public attention when they occur.

Injury prevention is being addressed through many collaborative efforts in the Atlanta area, including the Centers for Disease Control and Prevention (CDC) funded Emory Injury Prevention Center headed by Dr. Deb Houry. Nationally, according to the CDC, TBI has a high incidence in children and accounts for 473,947 emergency room visits, tens of thousands of hospital admissions, and 1,250 deaths annually.[1] Unfortunately we see the entire spectrum of those suffering from TBI on a daily basis.

The mechanism of injury in a TBI is two-fold. First, the mechanical damage from the energy of the trauma causes direct tissue contusion, bruising and tissue disruption. Second, the swelling and subsequent re-profusion of the affected tissue may lead to additional damage to neurons. Ultimately, the deficits seen from a traumatic brain injury are determined directly by which portion of the brain sustains the injury. For example, injuries to the right posterior frontal cortex affecting the primary motor cortex cause weakness of the arm, leg and/or face on the left side of the body. Severe injuries may have effects on multiple systems and can impact movement, sensory perception, language, cognition, automatic body functions or neuro-endocrine systems. Unlike with adults, the pediatric brain is affected by interruption of neural development as well. Thus, the damage not only causes immediate effects, it also causes persistent concerns related to incomplete recovery as well as future deficits related to arrested cognitive and neural development.

Evaluation of traumatic brain injury in children varies depending on the timeframe of the examination and the desired information. For anatomical evaluation of the brain, imaging studies are useful. Early after injury, the imaging modality of choice is a Computerized Tomography (CT) scan. This allows screening for extra fluid on the brain (hydrocephalus), bleeding in the brain and skull fracture evaluation. However, given the life-long radiation exposure risk from CT scanning, such studies are reserved for those patients with a higher than minimal suspicion for acute intracranial injury following TBI.

Plain X-rays of the skull are not routinely ordered. Magnetic Resonance Imaging (MRI) studies of the brain are not typically ordered shortly after a TBI. MRI is more sensitive for parenchymal lesions than a CT scan, but is a longer study to complete and requires a level of medical stability for the patient that is not present in the early phases of TBI.

The critical question that patients, parents and families generally want to know about TBI is how to predict who will fully return to baseline status and who will have residual effects. Only 15 percent of all TBI patients will require admission to the hospital following their injury; thus the vast majority of cases are mild and have a very good prognosis for full or very near complete recovery.

In mild traumatic brain injuries like concussions, there are usually no residual significant effects. However, in a small cohort of those injured, there can be persistent headaches, vision changes, personality changes or changes in attention/cognition.

More severely injured children with TBI are identified by a series of findings that confer a less positive prognosis for recovery. These factors include: (1) a low score on initial evaluation of function and cognition via the Glasgow Coma Score immediately following the accident, (2) extended duration of unconsciousness, (3) the presence of bleeding inside of the brain, (4) seizures that continue more then 24 to 48 hours after the injury, (5) damage to diffuse areas of the brain rather than damage to a discreet focal area, (6) disruption of the automatic body functions controlled by the brain like breathing, heart rate and blood pressure, and (7) disruption of the neuro-endocrine axis that controls growth, kidney and hormonal function.

Ultimately, there is no single factor that independently guarantees a good or poor prognosis. Experienced clinicians, using a constellation of findings combined with the clinical history, can best estimate prognosis and set the course for interventions to help maximize recovery.

For the most severely brain injured children and adults, limited interventions other than supportive care during the initial stages of injury have been shown to be effective. However, recent groundbreaking work by Dr. David Wright and Dr. Donald Stein and their investigative teams from Emory University have shown new promise for those with moderate to severe TBI (Glascow Coma Scores of 12 or less on a 15 point scale). Preliminary trials at Emory have shown a neuroprotective effect from the early use of progesterone treatment in the acute management of adults with severe TBI. This has led to an ongoing federally funded multi-centered trial in adults evaluating the outcomes of this promising intervention.

Children's Healthcare of Atlanta and Emory investigators (Dr. Harold Simon and colleagues) have also teamed up with the Pediatric Emergency Care Applied Research Network nationally as part of a federally funded planning study for potential interventional trials of progesterone in children with severe TBI. While preliminary, these types of innovations keep Atlanta on the cutting edge for delivering hope for limiting the impact of this potentially devastating condition.

Following initial treatment and stabilization, nearly all children who sustain a clinically significant TBI ultimately undergo structured therapeutic interventions to maximize functional recovery. The setting of these interventions is determined by the TBI severity. Mild injuries are typically treated by providers as an outpatient. Physical Therapy (PT) focuses on gross motor skills, mobility, balance and coordination. Occupational Therapy (OT) focuses on activities of daily living, toileting and fine motor skills. Speech and Language Therapy (SLT) focuses on communication skills, cognition skills and swallowing.

Mildly injured children rarely need all of these services, but many are evaluated by a psychologist to test for cognitive, behavioral or executive functioning deficits. Feedback from these professionals is used to guide school, avocational and vocational restrictions following injury. More moderately injured children often need support from PT, OT, SLT and Psychology at a frequency that cannot be achieved through individual weekly appointments. Thus, moderately injured children may start their rehabilitation process in a structured outpatient "day rehab program." This allows them to get comprehensive services while not being required to stay overnight in the hospital.

The most severely injured children start aggressive rehabilitation while in the intensive care unit as soon as it is medically appropriate. Once they do not require monitoring at the level provided in the intensive care setting, the severely injured children transfer to an inpatient rehabilitation unit.

For children under 12, rehabilitation services happen nearly exclusively at pediatric centers. For those children from 12 to 21, there is the option for services to be provided at pediatric or adult centers. It is a difficult decision for a family to decide which setting is most appropriate, especially in the severe and complex cases. There are very high-caliber pediatric and adult facilities in the greater Atlanta area including: Children's Healthcare of Atlanta, Emory University Hospital's Center for Rehabilitation Medicine, The Shepherd Center, Wesley Woods Center, the VA Medical Center and others. Thus, the decision on where to receive care is driven by the needs of the patient and family preference.

Pediatric centers have teachers and educational professionals imbedded in their program, making it is easier for children in school, be it middle school, high school or college, to transition back into an appropriate educational environment.

Children's Healthcare of Atlanta offers world-class, state-of-the-art services in pediatric rehabilitation. Specially trained staff provides services for PT, OT, and SLT at the Scottish Rite and Egleston campuses. They focus on patients who have immediate post-operative needs or needs that are secondary to critical, immediate illness.

For patients who require intensive rehabilitation and continued medical management, the Comprehensive Rehabilitation Unit at Scottish Rite (CIRU) has the largest inpatient rehabilitation center for children in the country. The CIRU offers comprehensive and integrated services of traditional therapies and augmentative service like Music Therapy, Child Life Services, Recreational Therapy, Chaplaincy, Social Work and Case Management. Children's also has a wide array of outpatient offerings for therapy including the Day Rehabilitation Program, a comprehensive program focused on returning function and transitioning patients back into the school system, or services at one of eight outpatient therapy centers spread around the metro Atlanta area.

Traumatic Brain Injury is a common cause of acquired disability in children. The mechanism of injury is related to immediate and delayed factors. The severity of the injury determines the level of rehabilitation services needed to foster maximal recovery. Service location, in a pediatric center versus an adult center, is a key decision point for the patient and their family during recovery.

Fortunately, Atlanta is the home of world-class services and cutting-edge research for patients of any age who suffer a traumatic brain injury. We have a long road ahead, but the Atlanta medical community is leading the journey towards "healed" for this potentially devastating condition for children and their families. ■

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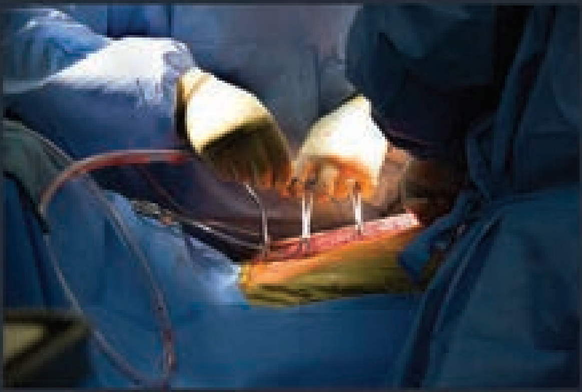

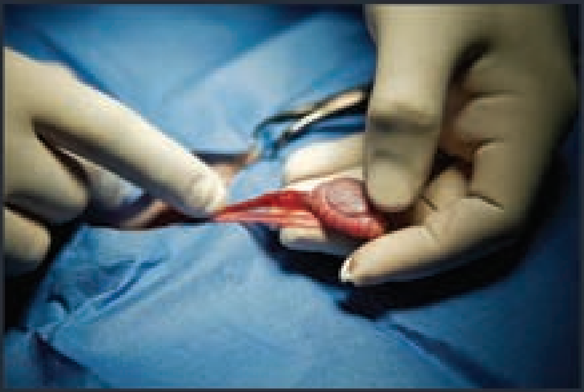

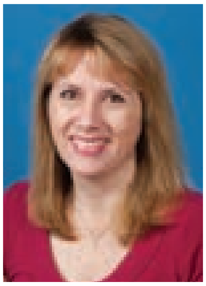

Lisa Kobrynski, M.D., M.P.H.

What's New in Newborn Screening?

Newborn Screening for Severe Combined Immunodeficiency (Severe T cell lymphopenia)

"Newborn Screening Saves Lives."[1] This is a headline that is music to the ears of clinicians and public health laboratories. Since the advent of newborn screening using heel-stick blood spotted on filter cards in 1981, more than 40 different conditions can be detected using tandem mass spectrometry to diagnose metabolic disorders and DNA analysis to identify mutations associated with cystic fibrosis and hemoglobinopathies. In 2010, the U.S. Department of Health and Human Services recommended the addition of Severe Combined Immunodeficiency (SCID) to the panel of primary conditions for newborn screening.[2]

SCID, popularly known as the "boy in the bubble" disease, is a congenital immune defect caused by more than 20 distinct single gene mutations. All infants with SCID have severe T cell lymphopenia at birth, and affected infants develop severe, life-threatening infections. Infants with SCID appear perfectly well at birth but begin to develop recurrent infections in the first few months of life. In addition to bacterial and viral infections, infants with SCID develop fungal and opportunistic infections (pneumocystis) and frequently have a severe erythematous, eczematous rash. As a result of the infections and malabsorption, failure to thrive is also a common feature of these disorders.

Without immune reconstitution, SCID is uniformly fatal with very few infants surviving beyond the first year of life. Previous studies estimate the birth prevalence of SCID at 1:100,000 live births,[3] but clinical immunologists have long felt that this is an underestimate of prevalence and that many cases are missed.

Immune reconstitution for this immunodeficiency is done through a bone marrow or hematopoietic stem cell transplant (HSCT). Transplants can be performed in the first months of life; if performed before 3.5 months of age, the rate of success is greater than 95 percent.[4] Outcomes after transplantation are dependent on the age of the infant at transplant, the type of SCID, the donor and the presence of uncontrolled infection. It is clear that early intervention is critical for a good outcome.

SCID is the first primary immunodeficiency disease (PIDD) to be recommended for newborn screening (NBS). For a disorder to be considered a candidate for newborn screening, it must have significant impact (eg: life threatening), effective therapies must be available, early (presymptomatic) intervention must be important, and a sensitive and specific (and inexpensive) screening test must be available. In 2005, Chan and Puck[5] published a report of a method measuring T cell receptor excision circles (TREC) DNA using a quantitative PCR from dried blood spots (DBS). They demonstrated that this assay reliably identified infants with SCID.

In 2008, Wisconsin added the TREC assay to their NBS program. Currently five states are screening for SCID by measuring TRECs in newborn DBS. To date they have screened more than 900,000 infants and identified more than 24 cases of SCID. This suggests that the birth prevalence is approximately 1:38,000 (personal communication ACMG), more than twice as high as previous estimates.

Newborn screening for SCID is a first in many ways. Not only is it the first PIDD to be recommended for NBS, but it is the first NBS test to use a DNA-based assay as the primary screening test. An abnormal screening test reports the absence of TREC DNA in the DBS, this must then be confirmed by obtaining a blood sample and measuring the numbers of T, B and NK lymphocyte subsets by flow cytometry. Referral to a center with experience caring for children with Primary Immunodeficiencies is recommended. Any infant with suspected SCID should not be given any live vaccines and may be started on antibiotic prophylaxis and receive gamma globulins (IVIG or SCIG).

At this time, at least 10 states are preparing to add newborn screening for SCID to their state panels. The American College of Medical Genetics and Genomics (ACMG) publishes the ACT sheet providing information regarding the screening test, as well as resources for practitioners. In addition, standards for performing the TREC assay are in preparation.

In the state of Georgia, the Jeffrey Modell Diagnostic Center for Primary Immunodeficiencies at the Emory Children's Center is the preeminent referral center for patients with a suspected PIDD. The director of the center, Dr. Lisa Kobrynski, is a nationally recognized expert in the diagnosis and treatment of PIDD, including newborn screening for SCID. Fortunately for children in Georgia, the Jeffrey Modell Foundation (JMF) center has teamed up with the Blood and Marrow Transplant (BMT) unit at Children's Healthcare of Atlanta at Egleston to provide life-saving transplants. Each year one to two new infants with SCID are diagnosed and treated at Emory Children's Center and Children's.

Obstetricians, pediatricians and neonatologists should be aware of the implementation of SCID screening in their state. They should be prepared to respond if an infant in their care is identified through newborn screening and they should become familiar with the specialized centers in their state that will ultimately provide care for these infants. Early detection and early initiation of therapy is key. This is one test that truly will save lives. ■

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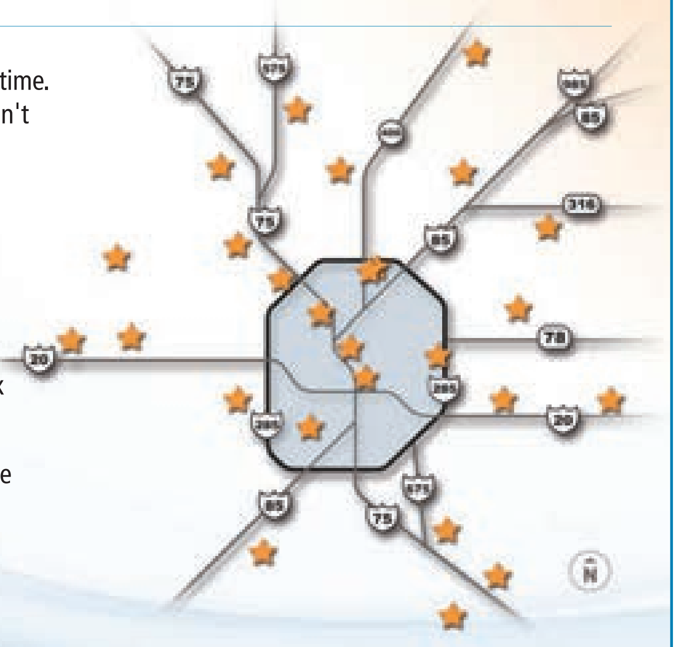

Parminder S. Suchdev,
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Global Child Health

A Call for Action

Global health is clearly in vogue. President Obama's massive Global Health Initiative has committed $63 billion to improving the health of women, newborns and children in low-income countries (www.globalhealth.gov). Several U.S. university presidents, including Emory's own Dr. James Wagner, voiced their support for global health at the first Consortium of Universities for Global Health held in late 2009. According to Bill Gates, "Dollar for dollar, global health is America's best investment for saving lives."

Global Health Defined

But what is global health, and why as practicing physicians in Georgia should we care about the health of children in Africa when we have our own health crisis here in the U.S.? According to former CDC Director and current leader of the Emory Global Health Institute, Dr. Jeffrey Koplan, global health is "a field of study, research and practice that places a priority on equity in health for all people."[1] In addition to health work involving countries beyond one's own, global health stresses the commonality of health issues that requires collective, interdisciplinary action.

There are many explanations for the growing interest in global health, not only by governments, the media, educational institutions and philanthropists but by American physicians. With increased globalization, the world is becoming a "smaller place." Increases in immigration and international adoptions have led to more U.S. physicians caring for patients from developing countries. In the intimately intertwined sociopolitical and economic web of today's world, changes in the health of people in one area of the world can quickly impact the well-being of people globally. Finally, the culture of medicine emphasizes service to those in need, and it is common to find today, perhaps more than ever before, trainees and faculty committed to working beyond the borders of "first-world" medicine.

State of Global Child Health

The motto of the American Academy of Pediatrics (AAP) declares that as pediatricians, we are "dedicated to the health of all children." However, 90 percent of the world's children live in developing countries where barriers to health, including poor control of infectious diseases and chronic disease prevention, malnutrition, healthcare worker shortages and environmental health issues, contribute to significant child morbidity and mortality.[2-3] While there have been notable improvements in childhood mortality (e.g., 7.7 million under-five deaths in 2010 down from 12.4 million in the 1990), more than 80 percent of these deaths occurred in south Asia and sub-Saharan Africa alone, and less than 1 percent occurred in high-income countries.[4] Furthermore, the leading childhood killers are largely preventable, and effective interventions are available to reduce child mortality.

Although health inequities may be most visible in the developing world, one does not need to travel far to find significant disparities in healthcare. Metropolitan cities such as Atlanta have large numbers of indigent groups, immigrants, refugees and international adoptees with very specialized needs, requiring knowledge of the diseases and conditions in their respective countries of origin. In Dekalb County, which is the most diverse county in the state of Georgia, nearly one out of every six residents is foreign born.[5] In the last decade, more than 28,000 foreign nationals moved into DeKalb, representing 35 percent of the net international migration into metro Atlanta. On any given day, more than 130 different languages are spoken in DeKalb's public school system. Clearly global health is local health.

PHOTO: PARMI SUCHDEV, MD MPH

Pediatrics resident Joanne Garde, right, working alongside a Brazilian medical student (center) testing child for anemia in Vespasiano, Brazil, in July 2011.

Global Health Education in U.S. Pediatric Residencies

In recent years, global health has become an increasingly valued dimension of medical education, primarily in response to demands of trainees. Given the well-documented educational benefits and the need to solve issues of health disparities around the world, increased resources for global health training are urgently needed.

In medical schools, the percentage of graduates who participated in an international health experience during medical school has increased steadily.[6] For example, in 1978 only 5.9 percent of graduating American medical students completed a clinical education experience abroad as part of their medical education. By 2004, this percentage had increased to 22.3 percent and to 30.8 percent in 2010.[7]

Pediatric residency training programs are also beginning to respond to the growing interest in global health through the implementation of global health curricula, tracks and fellowships. Although more than half of U.S. pediatric residency programs already have global health opportunities for their residents, only 6 percent have formal global health curriculums or tracks.[8] The top children's hospitals have global health tracks; in fact, six out of the eight top children's hospitals identified in 2011 by U.S. News & World Report have formal global health programs, which are essential for attracting the best residents.

While the format of global health training offered by pediatric residency programs is variable, important components typically include a core global child health curriculum and associated local clinical experiences with underserved populations and/or through international electives. The nature of short-term global health experiences by trainees and agreements between institutions in rich and resource-poor countries raise numerous ethical challenges, which need to be addressed.[9-10] Groups such as the AAP Section on International Child Health have proposed global child health competencies for all pediatric residents that are aligned with the Accreditation Council for Graduate Medical Education (ACGME) competencies for overall resident education. However, no formal curriculum framework has been established upon which to model global health training programs within pediatric residencies. Emory University is leading a national working group to design a model curriculum in global child health to guide pediatric residency programs.

Pediatrics Global Health Track Comes to Emory

In 2008, the Global Health Organization of Pediatrics at Emory (GHOPE) was founded to increase awareness of global health and identify opportunities for global health training for pediatric residents. GHOPE is primarily trainee-driven, whereby Emory medical students, residents and fellows organize noon and evening seminars and documentary viewings, journal clubs, community outreach, an annual "Global Health Week" and a biannual newsletter that is disseminated to the entire Emory community. A needs assessment of pediatrics faculty and trainees conducted at Emory by GHOPE in 2009 found that 95 percent of residents and 64 percent of faculty wanted a global health educational track.

We are fortunate to have a breadth of global health resources available at Emory and Children's Healthcare of Atlanta, including the Emory Global Health Institute, Rollins School of Public Health (RSPH), the Centers for Disease Control and Prevention (CDC), and multiple non-governmental organizations such as CARE and the Carter Center. Seizing the opportunity to be a leader among training institutions in global health education, the Emory Department of Pediatrics (DOP) implemented a formal Global Health education curriculum in 2010. The goal of the curriculum is to ensure that all pediatric residents receive an introduction to global child health, including principles of public health, advocacy and clinical care of children in underserved communities both at home and around the world. The curriculum is an interdisciplinary collaboration between faculty and trainees in the DOP and RSPH.

The curriculum provides opportunities for all pediatric trainees, exposing them to public health principles, clinical and epidemiological research, advocacy and clinical training in underserved communities throughout the world. The tiered curriculum includes three potential levels of involvement:

Global Health Core Curriculum: Enhanced training in principles of epidemiology, social determinants of health, cultural competency and global burden of disease for all residents.

Global Health Track: Field experience (local or overseas) composed of clinical work and research preceded by formal coursework, web modules, and mentorship for select group of three to five incoming residents.

Global Health Fellowship: Specialty training with more extensive research and/or field experience through the Epidemic Intelligence Service (EIS) program at the CDC, National Institutes of Health (NIH) Fogarty Fellowship, or novel project development, also with the potential to obtain advanced degree for select group of one to two graduating residents.

This curriculum has already shown significant promise, being awarded an Emory University grant from the Fund for Innovative Teaching to implement the curriculum foundation. A set of monthly lectures in global health have been integrated into the core resident conference series, and an audience response system is being used as an interactive learning tool for self-assessment and course evaluation. We are in the process of identifying local and international field experiences in both clinical medicine and research. The first international site is being established in Minas Gerais, Brazil, where pediatric residents traveled with students from RSPH in July 2011. In addition, "local" global health experiences are being created at the Atlanta International Community School and the Dekalb County Board of Health refugee screening clinic, focusing on nutritional screening and establishing a medical home for refugee patients. By applying global health strategies locally, we believe our program can improve the health of some of the most vulnerable and needy in our own back yard. Depending on fund-raising efforts, approximately three to five interns will be selected for the global health track, starting in 2011-2012.

Opportunities for Action

The benefits that will come from Emory Pediatrics global health track are tremendous and will come at a low cost. With increasing health disparities at home and abroad, the world needs more knowledgeable and experienced physicians and other healthcare providers committed to careers in global health. This new program will position Emory and the Atlanta medical communities to attract the most outstanding, highly motivated and talented pediatric residents, who will help build the program and propel graduates into leadership positions in global child health.

We hope to engage the broader Atlanta community with our global health efforts. Our biggest challenge is raising sufficient funding to support our global health education programs. Moreover, we also hope to increase awareness of global health in the general community, to build sustainable partnerships with local and international institutions for resident field experiences and to attract volunteers to participate in didactic seminars and mentor our trainees.

The greater Atlanta medical and non-medical communities can contribute to these vital efforts. By taking the opportunity to think globally and act locally, we can better respond to the call for action to improve the health of all children. ■

For more information on global health activities in pediatrics, please visit our website at: http://www.pediatrics.emory.edu/education/Global%20Health/index.html

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Brian E. Costello, M.D.

Naghma S. Khan, M.D.

Common Pediatric Emergencies

Creating a Model For Quality Improvement and Regionalization of Care

Pediatric emergencies encompass a broad range of medical, surgical and traumatic conditions, which are complicated by the psychosocial, developmental and physical needs of a patient population that ranges in age from birth to 21 years.

In 2009, more than 20 percent of children had at least one emergency department (ED) visit. Over 24 percent of children less than five years old had one to three ED visits and 2.3 percent of this age group had more than three ED visits.[1] The most common complaints for ED visits in children less than 15 years were fever (15.1 percent), cough (6.6 percent), vomiting (5.5 percent), earache (3.5 percent), injuries to the head, neck and face (5.5 percent), rash (3.1 percent), abdominal pain (2.9 percent), and sore throat (2.8 percent).[2] Caregivers cited inability to get a same day appointment with the primary care physician as well as convenience and efficiency as reasons for seeking non-emergent care in an ED.[3]

A child life specialist explaining a procedure to a child

Children's Healthcare of Atlanta (CHOA) has three EDs, which are located at the Egleston, Hughes Spalding and Scottish Rite facilities. Combined, these EDs care for more than 200,000 visits annually. Although large numbers of patients are seen in our CHOA EDs, a large proportion of children are also seen in community EDs, which are less likely to have the broad base of pediatric expertise and equipment available at a Children's facility.

Over the past 10 years, CHOA and Emory have collaborated to create a network that ensures local and regional outreach for pediatric care, through open access to clinical guidelines, web-based resources, continuing medical education, telemedicine and preceptor programs. When a community physician requires specialized advice or support, CHOA's Transfer Center can provide immediate access to subspecialty consultants, inpatient or ICU admissions or ED care. The Transfer Center is staffed with experienced pediatric emergency and critical care nurses who seamlessly handle the myriad of calls they receive. The Center receives more than 27,000 calls a year resulting in approximately 13,000 ED-to-ED transfers, 10,000 direct admissions and 3,000 subspecialty consultations.

Fever, perhaps the quintessential symptom of pediatric illness, is often a source of concern and anxiety in caregivers. While most pediatric fevers are due to self-limited viral processes, these benign causes must be distinguished from serious bacterial infections, including pneumonia, urinary tract infection, bacteremia and meningitis. Implementation of evidence-based, age-specific clinical guidelines, which focus on a thorough history and physical examination, supplemented by judicious use of diagnostic testing, has significantly decreased treatment with broad-spectrum antibiotics without adversely affecting outcomes in the 0-36 month age group. Fever is a true emergency in immunocompromised patients, such as those with sickle cell disease, transplants and malignancies. Using evidence-based, nurse-initiated protocols, we are able to ensure timely initiation of antibiotics in this high-risk patient population. More than 70 percent receive the first dose of antibiotics within 60 minutes of arrival.

Coughing can represent conditions ranging from minor to life-threatening. Visits for croup, influenza and bronchiolitis are predominantly seen during the winter respiratory virus season, while childhood asthma exacerbations as well as foreign body aspirations and pertussis remain serious concerns year-round. Unlike the adult population, where cardiac disease predominates, the majority of resuscitative events in children are respiratory in origin.

ED providers need to be adept at recognizing impending respiratory failure and be well versed in a wide variety of interventions like airway repositioning, suctioning, oral and nasal airway insertion, supplemental oxygen administration, noninvasive positive-pressure ventilation and endotracheal intubation. At CHOA, nurses and respiratory therapists initiate therapy for asthma and bronchiolitis upon patient arrival using comprehensive, evidence-based management pathways based on clinical respiratory scores, thus ensuring expeditious care for this vulnerable population.

Acute gastrointestinal losses from vomiting and/or diarrhea may quickly lead to dehydration and hypovolemic shock in young children. ED providers have to rely on alternate signs of shock, such as tachycardia, tachypnea, abnormal pulses and skin temperature, prolonged capillary refill time and alterations in mental status, because hypotension is a late finding. Early and aggressive fluid resuscitation is now easily achieved with more widespread use of intraosseus infusion tools. Causes of abdominal pain range from gastroenteritis and inflammatory bowel disease to surgical emergencies like acute appendicitis, volvulus, intussusception, pyloric stenosis, and ovarian and testicular torsion.


Children's Healthcare of Atlanta Clowns

Radiation risk from the use of computed tomography (CT) scan in children is well documented in the literature[4]. CHOA ED physicians receive a quarterly score card comparing their CT scan usage to their peers. Expanded availability of ultrasonography has provided alternative diagnostic modalities.

Injuries are a major public health problem in the U.S. with more than seven million children under 18 years with unintentional injuries and more than 300,000 children with violence-related injures seen in EDs each year.[5] These injuries commonly include lacerations, fractures and head injuries.

CHOA employs a number of modalities to allay pain and anxiety in trauma victims, including triage protocols for early administration of oral pain medications, local anesthetic application to lacerations and the use of certified child life specialists to entertain, educate and distract patients before and during procedures. Procedural sedation is provided for wound repair and fracture management where appropriate. Minor fractures are typically splinted/casted in the ED, with follow-up arranged with a pediatric orthopedic specialist. For young athletes with concussion, CHOA offers a multidisciplinary concussion program to ensure smooth recovery and safe return to play.

Children's at Egleston received its Level 1 trauma status in October 2011, which is a validation of the excellent trauma care CHOA and Emory physicians have been providing for years.

Georgia's regional poison control center is a valuable resource for parents and healthcare providers in managing toxicologic emergencies ranging from ingestion of medications and household chemicals to snake, insect and arachnid envenomation. With larger ratios of body surface area to mass, children are also more susceptible to heat- and cold-related illnesses during outdoor play and sports activities.

Children with chronic medical conditions frequently present for emergency care. These range from ventilator-dependant and other technology-assisted patients to children with malignancies, congenital cardiac disease, cystic fibrosis, severe asthma, sickle cell anemia, end-stage renal disease, type 1 diabetes, neurological disorders, bone marrow and solid organ transplantation, metabolic disorders and complications of extreme prematurity.

Nationwide and at CHOA, several initiatives are under way to increase efficiency, improve outcomes, decrease costs and reduce practice variation in the emergency care of children. "Defining Quality Performance Measures for Pediatric Emergency Care," a project funded by the federal Emergency Medical Services for Children program, has identified several performance-based measures that include the documentation of weight in kilograms, identifying age-based abnormal vital signs, availability of pediatric-specific equipment, parent/caregiver understanding of discharge instructions, reduced door-to-provider time and total length of stay, reduced pain from acute fractures, limited CT-utilization in minor head trauma, protocols for suspected child abuse, delivery of systemic corticosteroids in acute asthma exacerbation, evidence-based guidelines for bronchiolitis, reduced antibiotic use in children with viral illness, reduced return visits within 48 hours resulting in admission and reduced rates of medication error.[6] These efforts aim to improve the quality of emergency care provided to children of all ages and acuities – from newborn to adolescent, from the well-appearing to the critically ill throughout the region and Atlanta's extensive referral base. ■

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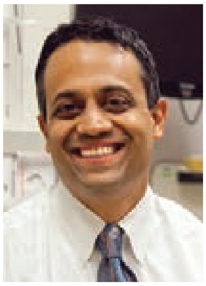

Kiran Hebbar, M.D., F.A.A.P.

Simulation in Pediatric Medical Education

How “High Tech Dummies” Are Revolutionizing Pediatric Healthcare Training

Medical education has traditionally relied on the concept of ”see one, do one, teach one” to educate learners. However, with increasing numbers of trainees and reduced training hours, there are fewer real patient opportunities for learners to be exposed to less common medical conditions.

Following release of the Institute of Medicine’s report, *To Err is Human: Building a Safer Health System*, patient safety has become a major focus in healthcare, and educators are emphasizing the need for more hands-on learning before medical trainees have contact with real patients. Therefore, new approaches to medical education are required, and simulation using realistic mannequins and scenarios helps provide needed training opportunities.

What is Simulation?

Simulations “scenarios” are cases designed to closely approximate real-world situations for the purposes of training and evaluation. Modern-day simulation finds its roots in commercial aviation, nuclear power and the military, where inherent risks of catastrophic error exist on a daily basis and where training in the real world would be too costly or dangerous.

The era of modern medical simulation began with the first “high-fidelity” simulator designed by Denson and Abrahamson[1]. Fidelity is the extent to which the appearance and behavior of the simulator or simulation match the appearance and behavior of the simulated system. High-fidelity simulators facilitate student interaction by providing direct feedback in the form of physical findings such as heart sounds, breath sounds, palpable pulses, blinking eyes and even speech. Patient responses, generated by the mannequin’s operator through a computer-driven model, allow vital signs to change in response to administered medications or interventions.

Because of their extensive life-like capabilities, simulators can be quite expensive, approximately $40,000 to $50,000. Nonetheless, developing simulation programs that teach a variety of health care providers the cognitive, technical and behavioral aspects of managing a wide array of medical conditions is a wise investment.

How is Realism Achieved in Simulation?

Although simulation experiences are designed to be as real as possible in order to facilitate experiential learning, there are many challenges inherent in achieving this realism. This underscores the tremendous advantage of using high-fidelity simulation in which the simulator is able to mimic real physical findings and real physiological responses.

However, the cost and limited availability of high-fidelity simulators means that they cannot be used in all areas of medical training – yet. To maximize their value and potential, medical educators aim to match the amount of realism to the desired educational objectives of the simulation session.

For simulations in which a high degree of realism is desired, the primary goal of the simulation-based educator should be to “suspend disbelief,” allowing students to immerse themselves in learning experiences that most closely match those encountered in real life. Realism can be created in a number ways, such as replicating the environment, documentation, patient monitors, addition of multidisciplinary team members, using actors, limiting instructor involvement during the scenario and requiring the utilization of normal resources (i.e. drawing code drugs and requiring them to be given through an IV to the mannequin).

Benefits of Simulation

With few opportunities for hands-on practice with real patients, certain skills are taught didactically. Limited opportunities to practice skills, especially in pediatrics, impair learner proficiency and performance, erodes provider confidence and increases the chances of medical errors or adverse outcomes.

Incorporating David Kolb’s Experiential Learning Model[2], simulation can provide a learning experience that incorporates key elements to make the experience realistic (the simulation) with immediate “real-world” relevance. A major benefit of simulation education in pediatrics is that it increases exposure to acutely ill or injured children in an immersive environment. Simulation provides additional and ongoing opportunities for experience and practice in the assessment and management of children and also enhances the capability for reflection, generalization and application.

Using simulation for team training, with the incorporation of human factors that contribute to medical errors, may have even greater benefits. The quality of team behavior has been shown to improve following simulation training and may lead to a subsequent reduction in the number of medical errors.

Pediatric Simulationin Atlanta

Over the last several years, there has been a dramatic increase in simulation-based pediatric training and education in greater Atlanta. In July 2009, Emory and Children's Healthcare of Atlanta developed the Pediatric Education, Safety and Quality Development Through Simulation (PEDSIM) program to enhance education of residents and other trainees.

PEDSIM facilitates team building and communication in a safe and controlled environment and helps residents and fellows learn to function as team leaders, applying physiologic principles in real time – before actually taking care of children. The Emory Center for Experiential Learning (ExCEL) provides a state-of-the-art facility for residents and fellows to receive task- and scenario-based training.

Simulation experiences also take place in patient rooms at Children's Healthcare of Atlanta hospitals, where medical teams are called upon to manage and care for a child without any forewarning (i.e. mock codes). This "in situ" simulation adds the highest degree of fidelity to any scenario. Additionally, the program helps interns become proficient at performing lumbar punctures by implementing "just in time training." Interns practice on a mannequin with supervision "just" prior to performing the procedure on a "real" patient. (PEDSIM link: http://med.emory.edu/excel/pedsim/)

This year, the Children's Training, Excellence and Mastery through Simulation (TEAMS) Center was created. With a dedicated group of simulation experts and specialists, the TEAMS center will aim to embed key elements of crisis resource management (CRM), such as role clarity, team building concepts and enhanced communication skills with healthcare providers. These CRM principles are of paramount importance to high-quality and safe healthcare delivery.

Benefits of Simulation

- Immersive, experiential learning
- Reflective learning
- Multifaceted learning: Knowledge, skills and attitude
- On-demand learning: Increased exposure to various common and uncommon diseases
- Safe, risk-free learning environment
- Skills can be practiced repeatedly
- Ability to evaluate new equipment, interventions, treatment protocols and procedures
- Multidisciplinary team training
- Allows for assessment of learners with standardized clinical scenarios

Using portable high-fidelity mannequins, we simulate a variety of clinical situations in an effort to standardize workflow and provide staff and physicians experience in managing infrequent but critical events. Thanks to the generous support of Neal and Joan Allen, a simulation room equipped with video-recording capabilities is being constructed at Scottish Rite that will provide a dedicated area within the children's hospital for medical staff to train.

These are just the beginnings of a vision to have simulation play a key role in education, quality and safety for the children of Atlanta. In the future we will be conducting continuing medical education (CME) programs, expanding to satellite outpatient care clinics and developing community outreach programs for local healthcare providers to increase exposure to pediatric-based procedures and patient management.

By incorporating simulation into routine medical training at Emory and Children's Healthcare of Atlanta, we hope to use this novel educational vehicle to continually improve safety and quality of care to pediatric patients throughout our community. We are also working to become a model program nationally for use of simulation in graduate and continuing medical education. ■

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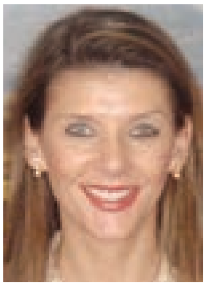

Avril Beckford, M.D.

James Fortenberry, M.D.

A Vision for Diabetes

Type I Diabetes (T1DM) is a unique and potentially devastating diagnosis: currently treatable but without a cure, it impacts every moment of every day.

We have an opportunity and an obligation to enhance the lives and care of Georgia's children, teens and families with T1DM.

How can we do a better job of caring for these children? The time is now and the place is Atlanta. Why? Because by far, Atlanta has more children with Type I Diabetes (T1DM) than any other city in the nation. Close to 600 children and adolescents are newly diagnosed with T1DM in Atlanta each year, and more than 4,000 established pediatric patients receive T1DM care in metro Atlanta. Such a high number of chronically ill children can exceed our current capacity to meet their needs, and the Diabetes Vision Team at Children's Healthcare of Atlanta has a plan to change that.

While these children receive excellent care for their diabetes, there is a growing recognition of the need to better coordinate and manage the care of the overall pediatric T1DM population in a more directed fashion. The Diabetes Vision team is made up of pediatric endocrinologists, nurse practitioners, inpatient diabetes team leaders, diabetes educators, social workers, diabetes researchers and the executive director of Camp Kudzu, Georgia's largest camp program for children with T1DM.

The vision is for a three-step approach to development of the Center, following the path of a child's growth:

The Infant Phase: The team has developed this first phase as a "virtual center". Our endocrinologists and nurse practitioners from all practices have already made several achievements which include:

- The creation of diabetes glucose management protocols that are consistent across practices. These pathways have been developed to allow practice staff to guide therapy for

Patient Type and Title: 0 - Inpatient : Age (Years): 0 - 17 : Outliers: Include : Normal Newborns: Exclude : Mortalities: Include : Severity Level (v24): 1:2:3:4 : Target

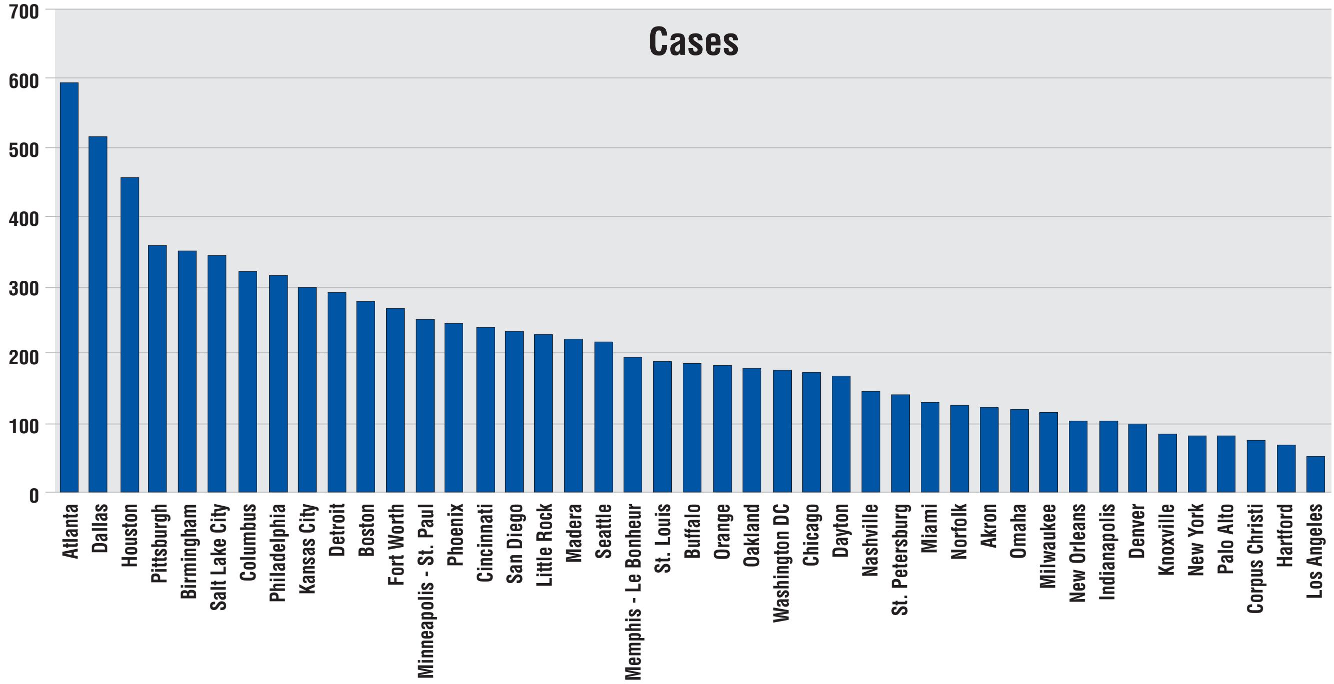

Figure: Data from the Pediatric Health Information System on new reported cases of T1DM by city in the United States from October 1, 2009, to September 30, 2010. Atlanta reported the largest number of cases in the country during this period.

families whose child has high or low glucose during their daily checks, or during one of their "sick days". This is not only much less confusing for patients and families, but should enhance long-term outcomes. The protocols can be used in a variety of settings, from outpatient practices to Emergency Departments (ED), and eventually in a web-based fashion. They also provide excellent educational tools for training new practitioners in diabetes care. These are consensus-driven, evidence-based protocols, developed by the collaborative efforts of nurses, educators and endocrinologists throughout Atlanta.

- The endocrinologists are completing a streamlined, systems-based pathway for treating diabetic ketoacidosis (DKA) from facility transfer, through the ED and intensive care unit (ICU), to the floors and home, with consistency and a focus on education.
- The Quality team has developed an online inpatient diabetes registry, capturing real-time inpatient data to track patient outcomes and monitor re-admissions. Our goal is to enhance education and outpatient management to limit returns to the hospital for acute DKA.
- The Children's Diabetes Education team, under the leadership of Sue Tocher, is building on its strong programs by enhancing school-based health outreach.
- We have improved Children's diabetes website presence to provide more information and links to research study opportunities. Our goal for this website is to eventually help parents navigate the web to garner basic care advice.
- In an effort to find a cure, enhanced clinical diabetes research is supported by Children's and Emory. Dr. Eric Felner, Associate Professor of Pediatrics, Emory University, and his research team are offering opportunities to enroll patients in clinical trials of new drug therapies to treat, and potentially control, the progression of diabetes. The center is part of the Immune Tolerance Network, a federally funded consortium of diabetes centers evaluating immune suppressant therapies to slow the damage done to pancreatic islet cells producing insulin, to slow the advance of disease, and hopefully someday halt the damage before it reaches a need for insulin therapy. Studies include a novel trial to Induce Remission in New-Onset Type 1 Diabetes with Alefacept (T1DAL) and a phase II multi-center clinical trial evaluating whether intramuscular injections of the FDA-approved anti-psoriasis drug alefacept (Amevive®) can halt or slow the destructive autoimmune activity of T lymphocytes on residual insulin-producing pancreatic beta cells of patients recently diagnosed with T1DM. Opportunities for entering patients into this trial can be found at www.t1dal.org.

The Toddler Phase: The team has a vision to grow the efforts from virtual to physical in the next phase. One element will be utilizing a dedicated call line within the Children's Healthcare of Atlanta Call Center, where parents can call to speak with a nurse who uses the consensus protocols to guide advice and refer to a specialist as needed. Twenty-four hours a day, experienced staff could efficiently triage phone calls.

Establishing enhanced social services provision for the whole needs of these patients, including social work, psychology and counseling services, will be important. Additional programs could include development of an insulin pump clinic and enhance telemedicine advice for the state. A key element will be linking the center's efforts with those of Children's care for pediatric patients with obesity and Type 2 DM. Georgia has the 3rd highest rate of childhood obesity in the country, and utilizing the resources of both efforts will be important to combat the dual threats.

The Adolescent/Young Adult Phase: Ultimately, the team envisions a dedicated state-of-the-art center devoted to management, wellness and prevention of complications for our local pediatric diabetic population. Staffing the center would be nurses, nurse educators, psychologists, nutritionists and representatives from Atlanta pediatric endocrinology groups, all led by a medical director. A focus would be on meeting patients' social and clinical needs by offering, for example, networking opportunities, exercise and cooking classes. The ultimate long-term goal is to create a physical state-of-the-art medical home for children with T1DM. Patients with early DKA or complications will receive immediate interventions that aim to decrease hospital and ICU admissions. The Center could provide wellness, preventive and interventional care as well as providing access to research protocols.

Imagine a teen coming in for their quarterly evaluation. They first meet with the diabetes nurse educator to review their blood records. Then while waiting with five other teens who used to feel that they were the only ones who had to do this "weird blood glucose stuff," they bond, meet with a nutritionist, child-life therapist and Camp Kudzu representative and decide to volunteer at the next Camp session. They have their labs drawn and understand that the research being conducted is aimed at finding a cure. Finally, they meet with the endocrinologist on call for that day and feel positive, because it has all come together.

Until we find a cure for T1DM, frequent blood sugar checks, frequent insulin shots or pump-delivered insulin doses will continue to prevent the severe complications of a poorly controlled disease: ICU admissions, renal failure, vision loss and neuropathy. However, growing the Diabetes Center through these phases can lead us to an empowered approach to make a greater difference in the care and cure of these children throughout Atlanta and our region.

The vision of the Center for Diabetes is inspired. It is inspired by the need of a child – the need of many children. We believe the impact we will have on the lives of children with T1DM will be priceless. This is our moment. ■

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