

# Neurorehabilitation Updates

Collaborative care, innovative approaches, and research-driven therapies to help patients get back to their lives.



Kennedy Krieger Institute  
UNLOCKING POTENTIAL

FALL 2015 | VOL. 3, ISSUE 2

## A Word from the Director

Frank S. Pidcock, MD, Vice President of Rehabilitation at Kennedy Krieger Institute, Director of the Pediatric Rehabilitation Division in the Department of Physical Medicine & Rehabilitation, Johns Hopkins Hospital



Constraint-induced movement therapy (CIMT) is a “common sense” therapy for children with hemiparesis who have the potential for increasing their ability to use the affected upper extremity. It focuses on creating improved awareness and motor skills on the weaker side by limiting the use of the stronger arm with a constraining device, usually a cast, coupled with an intensive course of therapy. Repetitive, increasingly difficult tasks are employed through a process called “shaping” to encourage dexterity, speed, and strength of the involved hand or arm. Following the constraining phase of the program, bimanual therapy is instituted to teach the child to use both arms in two-handed tasks.

The rehabilitation team at Kennedy Krieger Institute recognized the importance of CIMT 11 years ago when the concept was first being expanded from adults to children. The team decided to develop an evidence-based clinical program that includes clinical research. Over the years, the Institute’s CIMT experts have authored numerous articles in peer-reviewed journals, book chapters, and presentations at national conferences. In 2011, a poster presented by this group won the best scientific poster award at the annual meeting of the American Academy of Cerebral Palsy and Developmental Medicine.

Over 110 children with a wide range of diagnoses have been treated in our CIMT program, which offers access to a variety of equipment including biofeedback, electrical stimulation, virtual reality devices, and assisted movement machines adapted to get the most out of the protocol.

This is an exciting time in the field of pediatric rehabilitation medicine. Technology is now available that “looks inside” the brain to yield insights into how CIMT molds neural circuitry to improve function. Transcranial magnetic stimulation and functional MRI brain imaging are techniques used at Kennedy Krieger to investigate the influence of therapies on the brain.

I hope you enjoy this issue of *Neurorehabilitation Updates*.

Best wishes,

Frank

## Rehabilitation Specialty Programs at Kennedy Krieger Institute

We have a wide variety of rehabilitation programs to meet the needs of patients at all levels. For a complete listing, please visit [Rehabilitation.KennedyKrieger.org](http://Rehabilitation.KennedyKrieger.org).

### Pediatric Inpatient Rehabilitation Program

- Brain injury
- Medical rehabilitation
- Pain rehabilitation
- Post-orthopedic surgery
- Spinal cord injury

### Outpatient Rehabilitation Programs

- Assistive Technology Clinic
- Brachial Plexus Clinic
- Brain Injury Programs:
  - Brain Injury Responsiveness Program
  - Interdisciplinary Brain Injury Clinic
  - Neurorehabilitation Concussion Clinic
- Community Rehabilitation Program
- Constraint-Induced and Bimanual Therapy Program
- Cranial Cervical Clinic
- Focused Interdisciplinary Therapy Program
- International Center for Spinal Cord Injury
- Limb Differences Clinic
- Occupational Therapy Clinic
- Orthopedics Clinic
- Pediatric Pain Rehabilitation Clinic
- Phelps Center for Cerebral Palsy and Neurodevelopmental Medicine
- Philip A. Keelty Center for Spina Bifida and Related Conditions
- Physical Medicine and Neurorehabilitation Clinic
- Physical Therapy Clinic
- Seating Clinic
- Specialized Transition Program Day Hospital
- Speech and Language Clinic

### Related Services and Clinics

- Aquatic Therapy Program
- Audiology Clinic
- Behavioral Psychology Program
- Movement Disorder Clinics
- Neuropsychology Outpatient Clinics
- Nutrition and Weight Management Clinic
- Pediatric Psychology Clinic

# Reversing the Effects of Hemiplegia

## Constraint-Induced and Bimanual Therapy program for infants and children increases function and independence

When Leah was 6 months old, an MRI revealed the reason why she seemed to use the left side of her body much more than the right: she had likely experienced a stroke while in utero, resulting in hemiplegia. Fortunately, Leah was a good candidate for an intense therapy program that has been shown to greatly improve outcomes for patients with hemiplegia—the Constraint-Induced and Bimanual Therapy Program at Kennedy Krieger.

The program uses an evidence-based understanding of the brain's natural ability to form new connections and help increase function and independence. It combines traditional constraint-induced movement therapy—which involves casting the non-affected arm to force the use of the weaker arm—with an additional period of bimanual therapy to ensure carryover of new skills.

With the help of this therapy every day for a month as an infant, Leah learned to crawl, which is an impressive milestone for a child with hemiplegia and an important building block

for learning other gross motor skills. “When you’re an infant, using your hands and arms is really important—it’s how you move around, explore objects, crawl, and push yourself up,” says Teresa Garcia Reidy, MS, OTR/L, senior occupational therapist in the program.

Without therapy, children with hemiplegia develop a disregard for their affected limb that may persist

throughout life. But through early intervention using intense, repetitive movements, neuronal connections can be created and strengthened to help increase function of the affected limb and overall independence.

**Kennedy Krieger’s clinical constraint program was one of the first of its kind in the country, and is now the only program in the region offering this therapy for infants.**

“We are always looking for emerging techniques and equipment that can help our patients,” says Garcia Reidy. “If something is showing promise in current research, we are willing to try it out.”

Since 2004, the program has seen more than 100 children. Because of their clinical expertise, Garcia Reidy and her team were able to publish the first clinic-based outcome study demonstrating the effectiveness of the therapy.

Leah underwent three different bouts of therapy, focusing on a different set of skills at each stage of development. Because of Kennedy Krieger’s interdisciplinary team approach, Leah was also able to receive speech therapy to address stroke-related communication difficulties, in addition to occupational and physical therapy, all in the same visit. “Nowhere else could we get that much therapy in a row,” says Leah’s mother, Maria. “That therapy was life-changing.”

These days, Leah is working on skills to prepare her for school, such as dressing herself, carrying objects with both hands, opening a marker, and turning pages in a book. These skills would have been very challenging without the early intervention she received.

Individual constraint-induced and bimanual therapy is offered for both infants and children. In summer, a group camp-like model is offered for school-aged children.

To learn more or to make a referral, visit [KennedyKrieger.org/Constraint-Induced-and-Bimanual-Therapy](http://KennedyKrieger.org/Constraint-Induced-and-Bimanual-Therapy).



Leah as an infant, with Teresa Garcia Reidy, MS, OTR/L.



Since 2004, the Constraint-Induced and Bimanual Therapy Program has helped more than 100 children with hemiplegia increase function in their affected limbs, leading to improved independence. (above) Leah, age 3, with Teresa Garcia Reidy, MS, OTR/L.

## From Bench to Bedside

Kennedy Krieger's clinicians and researchers are leaders in the worldwide effort to prevent and treat disorders of the brain, spinal cord, and musculoskeletal system. Our investigators continue to research critical areas such as the role of genetics in developmental disorders, break new ground with innovative imaging technology, and develop new treatment models and therapies. Selected recent research from our team on Constraint-Induced Movement Therapy includes:

### Recent Peer-Reviewed Scientific Papers

Pidcock, F.S., Garcia, T., Travato, M., Schultz, S.C. & Brady, K. Pediatric Constraint-Induced Movement Therapy: A Promising Intervention for Childhood Hemiparesis. *Topics in Stroke Rehabilitation*. 2009. 16(5):339-345

Garcia Reidy, T., Naber, E., Viguers, E., Allison, K., Brady, K., Carney, J., Salorio, C., Pidcock, F. Outcomes of a Clinic Based Pediatric Constraint Induced Movement Therapy Program. *Physical & Occupational Therapy in Pediatrics*. 2012. 32(4):355-367

### Book Chapters

Coker-Bolt, P., Garcia Reidy, T. & Naber, E. Alternative Pediatric Constraint Induced Movement Therapy: Understanding the How and Why of Clinical Variations of Pediatric CIMT. In *A Handbook of Pediatric Constraint-Induced Movement Therapy (P-CIMT): A Guide for Occupational Therapy and Health Care Clinicians, Researchers and Educators*. 2013. Edited by S. Ramey, P. Coker-Bolt & S. Deluca. AOTA Press. Bethesda, MD.

Coker-Bolt, P., Garcia Reidy, T. & Trucks, M.R. Adapting Pediatric CIMT for Children with Brachial Plexus Injuries, Traumatic Brain Injury, Hemispherectomy and Other Surgical Interventions. In *A Handbook of Pediatric Constraint-Induced Movement Therapy (P-CIMT): A Guide for Occupational Therapy and Health Care Clinicians, Researchers and Educators*. 2013. Edited by S. Ramey, P. Coker-Bolt & S. Deluca. AOTA Press. Bethesda, MD.

Garcia Reidy, T., Naber, E. & Tsai, T. Novel and Complementary Therapy Strategies: Critical Issues and Opportunities for Combining with Pediatric CIMT. In *A Handbook of Pediatric Constraint-Induced Movement Therapy (P-CIMT): A Guide for Occupational Therapy and Health Care Clinicians, Researchers and Educators*. 2013. Edited by S. Ramey, P. Coker-Bolt & S. Deluca. AOTA Press. Bethesda, MD.

Coker-Bolt, P., Garcia Reidy, T. & Naber, E. Neuromotor: Cerebral Palsy In: *Occupational Therapy for Children 7th Edition*. 2014. Edited by J. Case-Smith & J. O'Brien. Mosby. Maryland Heights, Missouri.

### Recent Presentations

Garcia Reidy, T. & Naber, E. Poster: Speaking a Common Language About Participation: Using the ICF to Categorize COPM Goals April 2015. American Occupational Therapy Association Annual Conference, Nashville, TN.

Garcia Reidy, T. & Naber, E. Poster: Use of Robotics in a Pediatric Constraint-Induced Movement Therapy Program April 2015. American Occupational Therapy Association Annual Conference, Nashville, TN.

E. Naber, T. Garcia Reidy, E. Stashinko, F. Pidcock, J. Carney (September, 2014) Poster: Parent-Identified Goals for Children with Hemiplegia Enrolled in a Constraint Induced Movement Therapy (CIMT) Program Using the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY) American Academy Of Cerebral Palsy and Developmental Medicine 67th Annual Meeting, San Diego, CA.

Garcia Reidy, T., Coker-Bolt, P., Ramey, S., Deluca, S., Case-Smith, J. (April, 2014) Pre-Conference Institute 013: Pediatric Constraint Induced Movement Therapy (P-CIMT): How To Implement in Today's Practice Environment. American Occupational Therapy Association Annual Conference, Baltimore, MD.

Ramey, S., Trucks, M.R., Deluca, S., Garcia Reidy, T. & Coker-Bolt, P. Workshop (April, 2013) From Adult to Pediatric Constraint Induced Movement Therapy (CIMT): Theory and Evidence to Inform Today's Practices. American Occupational Therapy Association Annual Conference, San Diego, CA.

Garcia Reidy, T. & Naber, E. (November, 2012) Presentation: Robotics and Rehabilitation: Technology Update for the OT and PT Clinic. Brain Injury Association of Maryland Annual Conference, Timonium, MD.

For more information about research studies and clinical trials at Kennedy Krieger Institute, please visit [KennedyKrieger.org/Research](http://KennedyKrieger.org/Research).



Kennedy Krieger Institute

707 North Broadway  
Baltimore, Maryland 21205

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## Researchers Help Discover Hypothermia May Not Be Best Treatment for Cardiac Arrest in Children

A Kennedy Krieger Institute team, led by Drs. James Christensen and Beth Slomine, is part of a large-scale, NIH-funded multicenter research study that has shown therapeutic hypothermia, or whole body cooling, does not improve survival rates or mitigate brain injury in infants and children after out-of-hospital cardiac arrest. This emergency body cooling is known to improve survival and outcomes for adults after cardiac arrest and also for newborns deprived of oxygen at birth, but had not previously been studied in infants or children.

Drs. Christensen and Slomine collected and evaluated the children's outcomes at both three months and one year after treatment. At the one-year mark, researchers observed no difference in survival or cognitive function between groups. The research findings were presented at the Pediatric Academic Societies Annual Meeting in San Diego in April, and published simultaneously in the *New England Journal of Medicine*.

To learn more, visit [KennedyKrieger.org/Brain-Injury-Clinical-Research-Center](https://www.kennedykrieger.org/Brain-Injury-Clinical-Research-Center).

## New Physician Joins Kennedy Krieger Institute

Kennedy Krieger Institute is pleased to announce the addition of Sarah Korth, MD, to its medical staff. Dr. Korth will be a physiatrist in the Rehabilitation Department.

Dr. Korth comes to Kennedy Krieger from Thomas Jefferson University Hospital and Nemours A.I. DuPont Hospital for Children in Philadelphia, where she was a resident physician in pediatrics and physical medicine and rehabilitation. She is the founder and director of The Paraiso Project under Tree of Life International, a project to address the significant health disparities of the communities around Paraiso in the southwestern Dominican Republic, with the ultimate primary goal of self-sustainability.



Dr. Korth will see children with rehabilitation and physical medicine needs. To make an appointment with Dr. Korth or to learn more, call **443-923-9403** or email [FindASpecialist@KennedyKrieger.org](mailto:FindASpecialist@KennedyKrieger.org).