

Orthopaedic care moves toward multiple multidisciplinary clinics

A shift from one general orthopaedic clinic toward more specialized, multidisciplinary clinics is helping meet the unique needs of pediatric orthopaedic patients. Le Bonheur and Campbell Clinic physicians now staff nine different orthopaedic clinics.

"We know that different patients have different needs," said Pediatric Orthopaedic Surgeon James Beaty, MD. "Having multiple clinics allows us to cater care toward patients' unique needs and collaborate with other disciplines."

Beaty says more than three decades ago, outpatient care for patients with orthopaedic conditions or injuries was delivered in a general pediatric orthopaedic clinic. Children with anything from a broken



Clubfoot patient Ja'Kyria Cohen sees Derek Kelly, MD, in Le Bonheur/Campbell Clinic's Newborn Clinic.

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James Beaty, MD

bone to a congenital deformity were seen in the same setting.

Le Bonheur and Campbell Clinic added a Pediatric Fracture clinic 30 years ago and have continued to expand clinic offerings in the past five years.

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Research Spotlight: 2014

Studies focus on fracture epidemiology, tibial tubercle fracture outcomes, osteoarticular infection

MRSA responsible for most pediatric osteoarticular infection

Researchers at Le Bonheur Children's Hospital found that community-associated methicillin-resistant staphylococcus aureus (MRSA) is a leading cause of pediatric osteoarticular infection. The current study was conducted as a follow-up to the team's 2006 findings, which demonstrated an increased incidence and severity of MRSA-related bone and joint infection in children.

"It was important to follow up on our past study to evaluate the evolving pattern of osteoarticular infection," said Derek Kelly, MD, a pediatric orthopaedic surgeon. "It appears that the upward trend in frequency of MRSA osteoarticular infections has stabilized."

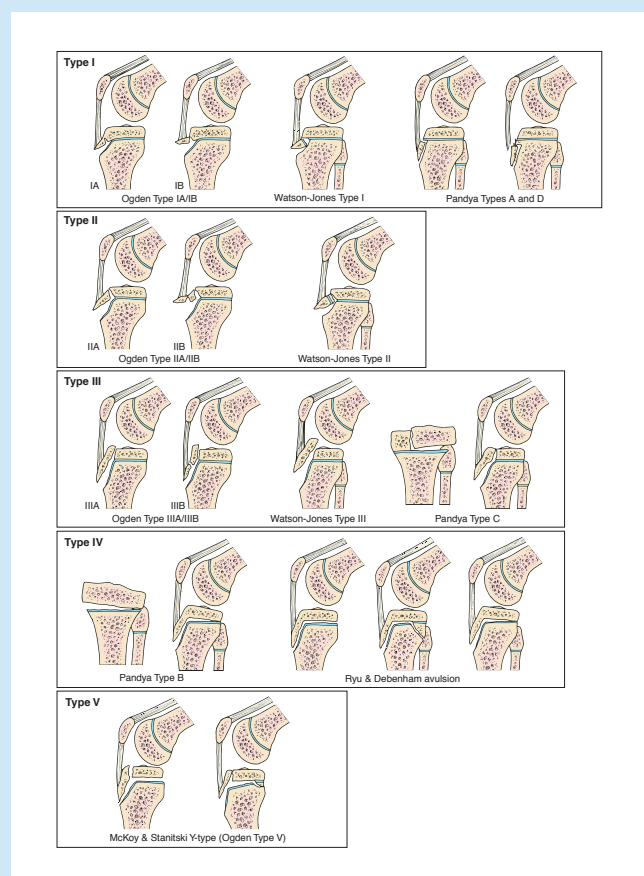
Comorbidities and complications in association with MRSA infections can include deep venous thrombosis and septic pulmonary emboli.

Researchers reviewed the medical records of all patients treated at Le Bonheur and Campbell Clinic for acute hematogenous septic arthritis and osteomyelitis between January and December 2011. Of the 240 patients in the study, 100 were diagnosed with MRSA osteoarticular infection; 51 had methicillin-susceptible staphylococcus aureus (MSSA) infection. Other findings include:

1. Overall rate of infection was 4.29 cases per 1,000 hospital admissions.
2. Subperiosteal abscess was evident in 51 percent of MRSA and 45 percent of MSSA infections (compared to 17 percent of culture-negative patients).
3. Mean age of patient with MRSA (6.4 years) was significantly lower than age of patients with MSSA infection (8.9 years).
4. Surgical intervention was required in 87 percent of MRSA cases and 84 percent of MSSA patients.
5. Eight MRSA patients developed chronic osteomyelitis (only one case in MSSA patients).

Current treatments for tibial tubercle fracture produce good results, study says

Current treatment methods for pediatric tibial tubercle fractures produce good clinical and radiological results regardless of fracture type, according to new research findings. Le Bonheur/Campbell Clinic researchers performed a systematic



review of the literature that covered more than 330 cases of tibial tubercle fractures, classifying them by type and evaluating their treatment, complications and outcomes.

"Because tibial tubercle fractures are fairly uncommon injuries, most published series contain small numbers of patients. We chose to perform this systematic review of the literature, so we could compile the highest quality studies on this fracture into one series of patients," said Jeffrey Sawyer, MD. Highlights from the study include:

1. Average age at surgery was 14.6 years.
2. Most common fracture reported was type III.

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Ortho team adds Mehta Casting table

The Le Bonheur/Campbell Clinic Pediatric Orthopaedic team recently added a Mehta Casting table for the treatment of infantile scoliosis. With this new table, pediatric orthopaedic spine surgeons will be able to apply a corrective body cast for babies and toddlers with scoliosis.

“It is the only scoliosis treatment that has been showed to ‘cure’ any form of scoliosis without surgical incisions,” said Pediatric Orthopaedic Surgeon Derek Kelly, MD.



“We’re adding more and more clinics for our patients. The expansion has really accelerated over the last five years,” Beaty said.

The orthopaedic team now leads nine separate clinics, including specialized clinics for newborns with congenital abnormalities, children with neuromuscular conditions and two distinct clinics for scoliosis patients. The team still holds a weekly general pediatric orthopaedic clinic to allow for more accessibility, says Beaty.

The biggest benefit is the increased collaboration with other pediatric specialists. Le Bonheur’s Muscular Dystrophy Association Clinic, for example, gives patients a chance to meet with neurologists, cardiologists, pulmonologists, physical therapists, respiratory therapists, social workers and clinical nutritionists all in one place during a single appointment.

Le Bonheur/Campbell Clinic pediatric orthopaedic clinics include:

- Newborn (Clubfoot)
- Muscular Dystrophy Association
- Spina Bifida
- Fracture
- Early-Onset Scoliosis
- Scoliosis
- Hand
- Pediatric Orthopaedic
- Neuromuscular

Fellow graduates are satisfied, readily receive job offers

POSNA group measures workforce supply

Recent pediatric orthopaedic fellowship graduates are satisfied with their training experience and were able to readily find employment upon graduation, according to research conducted by a Pediatric Orthopaedic Society of North America (POSNA) committee. Le Bonheur/Campbell Clinic Orthopaedic Surgeon Jeffrey Sawyer, MD, was part of the committee that surveyed recent grads to determine if the field of pediatric orthopaedics is becoming oversaturated.

Pediatric orthopaedic fellowships are becoming increasingly popular. Until 2011, approximately 40 to 60 pediatric orthopaedic fellows graduated each year. Since then, the number of available fellowships increased to about 70. That jump has fueled concerns that there is now an oversupply of pediatric orthopaedists, making it difficult to find jobs in the field.

“It’s important to assess the quality and quantity of pediatric orthopaedic surgeons who enter the job market,” said Sawyer. “The aim of this survey was to determine the current environment for new pediatric fellowship graduates and provide insight into workforce planning.”

The POSNA committee electronically distributed a 36-question survey to 120 recent graduates of pediatric orthopaedic fellowships, ultimately obtaining responses from 81. The survey measured fellowship satisfaction, employment rates and satisfaction with their current job environment.

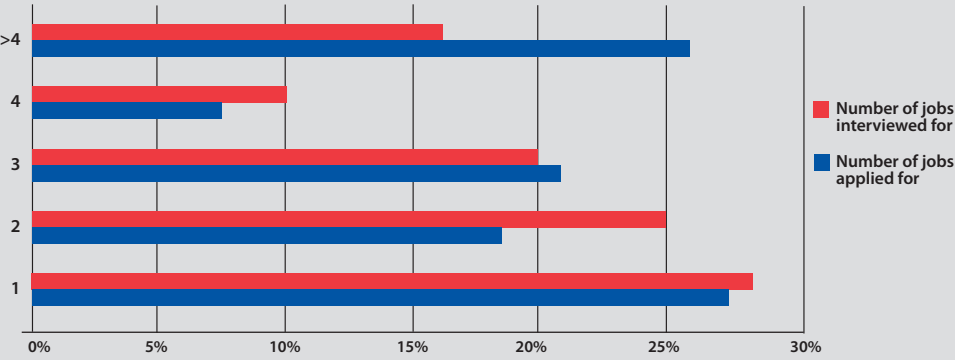
Results indicated that, despite concerns, 50 percent of respondents had at least one job offer before graduating, and only 2.5 percent did not receive a job offer. A surprising finding was the large number of graduates who pursued second fellowships and further subspecialty training.

“The demand for pediatric orthopaedic services is growing possibly because of the expansion of the scope of practice as well as subspecialization within pediatric orthopaedics,” said Sawyer.

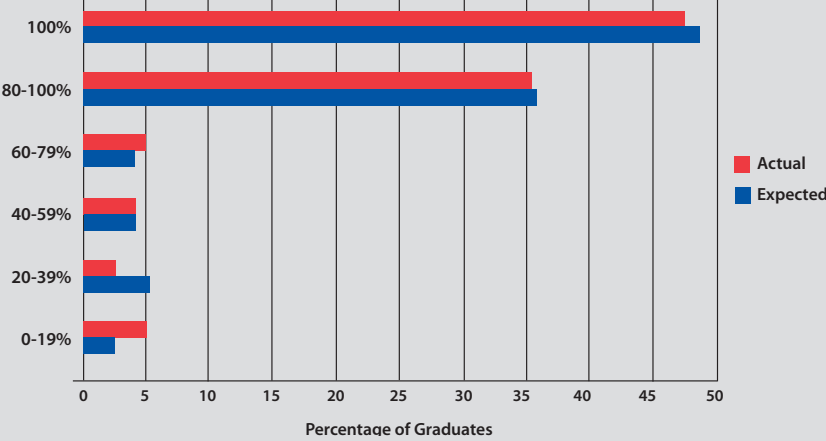
The survey also asked questions about whether the graduates’ current

practice included as much pediatrics as they expected. Most respondents have a practice that’s largely pediatrics, but adult trauma call is common, the survey showed. Most are satisfied with clinical volume and case complexity.

Number of Jobs Applied and Interviewed for



Volume of Pediatric Orthopaedics



- 3. Associated injury rate was 4.1 percent (more common in type III fractures).
- 4. Open reduction and internal fixation (ORIF) was performed in 98 percent of cases.
- 5. Fracture union was achieved in 99 percent of cases.
- 6. Overall complication rate was 28 percent (removal of hardware due to bursitis was most common complication).

Study looks at pediatric fracture epidemiology

The majority of pediatric fractures occur in the 10- to 14-year-old age group, and forearm fractures are the most common, according to a Le Bonheur/Campbell Clinic study. Researchers reviewed data from the 2010 National Electronic Injury Surveillance System (NEISS) and the 2010 U.S. Census to identify fracture risk.



Fractures of the forearm are the most common, accounting for 17.8 percent of all fractures, according to data compiled from the National Electronic Injury Surveillance System.

The injury is a common cause of emergency room visits. According to the study's findings, one in five children will experience a fracture at some point in their childhood or adolescence (rate of occurrence is 180 fractures per 1,000 children).

Most Common Pediatric Fractures 0-19 years of age

- 1. **Forearm bone fractures:** 1.69 per 1,000; and 17.8 percent of all pediatric fractures per year
- 2. **Finger bone fractures:** 1.39 per 1,000; 14.6 percent of all pediatric fractures per year
- 3. **Wrist bone fractures:** 1.34 per 1,000; 14.1 percent of all pediatric fractures per year
- 4. **Shoulder bone fractures:** 0.68 per 1,000; 7.1 percent of all pediatric fractures per year
- 5. **Hand bone fractures:** 0.66 per 1,000; 6.8 percent of all pediatric fractures per year

Source: 2010 National Electronic Injury Surveillance System

Ortho, endocrinology teams partner to care for children with OI

Le Bonheur/Campbell Clinic's orthopaedic team has joined forces with endocrinology specialists to provide care for children with osteogenesis imperfecta (OI), a congenital bone disease that causes fragile bones. The condition is rare, affecting only six to seven in 100,000 people, according to the National Institutes of Health. Children with OI experience repeated fractures, often with no apparent cause.

The multidisciplinary program offers children access to a variety of treatment options designed to give them the best shot at a normal childhood.

Le Bonheur Pediatric Endocrinologist Alicia Diaz-Thomas, MD, works with patients through the program to deliver intravenous pamidronate treatments. The medicine is injected slowly over a period of two to 24 hours

to slow bone breakdown and build bone density, reducing a child's risk of fractures.

"Pamidronate and other bisphosphonates cannot fix the underlying bone fiber defect found in OI, they constitute an important tool in the treatment of OI," Diaz-Thomas said. "Our team works with orthopedists and geneticists to discuss timing of these interventions and to make them happen at the right time."

Orthopaedic surgeons work with families to determine the best surgical or non-surgical treatment options, including intramedullary growing rods and other procedures to reduce the risk of repeat fractures and repair angular deformities.

Case Study: A'lee Stewart *Osteogenesis imperfecta*

Jacki Stewart used to be scared of her baby, A'lee. She worried she might break her.

At Jacki's last obstetric appointment before A'lee was born, an ultrasound showed what they thought was a broken leg. A'lee was born via Cesarean section on an April morning and did have a broken bone: her arm. She also had a soft skull, and physicians knew something wasn't right.

"We were speechless. We went from having a healthy pregnancy to then learning something was wrong," said Jacki.



A'lee Stewart

A'lee was transferred to the nearest children's hospital where genetics specialists diagnosed her with osteogenesis imperfecta (OI), a genetic bone disorder that causes fragile bones that break easily – a disease the Stewarts knew nothing about. They discovered A'lee had multiple broken ribs and two skull fractures in addition to her broken arm.

From there, the news got worse. Jacki and her husband, Chuck, were told their baby would never sit up or walk. That she'd be confined to a wheelchair for the rest of her life.

After leaving the hospital, the Stewarts were at a loss. Afraid to hurt baby A'lee, they carried her around on a pillow.

"I was scared of her. I didn't want to break her," said Jacki.

Looking for more hope for their daughter, the Stewarts were advised to see James Beaty, MD, a pediatric orthopaedic surgeon with Le Bonheur and Campbell Clinic.

"We loved him from the start," she said. "He had such a great outlook for A'lee. He said, 'let's fix the problems before they start.' He was determined that she would walk and be able to do everything a normal kid could do."

A'lee started regular Pamidronate treatments, an intravenous infusion given to strengthen the bone. Beaty also mentioned intramedullary rods – implants that provide stability and prevent fractures. They would need to wait, though, until A'lee was a bit older.

At age 2, A'lee had her first fracture since birth. She was trying to walk, fell and broke her femur. A year later, she had another femur fractures. Then, the morning



after her cast was removed, it broke again.

"The time to fix fractures is after repeat fractures of long bones or when angular deformity makes for high risk of recurrent fractures," said Beaty.

On Jan. 30, 2013, A'lee underwent a six-hour operation to implant intramedullary rods in both femurs. In a separate surgery a month later, A'lee also received rods in both tibias. The rods would help stabilize her bones, giving her the best shot at being a normal toddler. A'lee was in a spica body cast briefly as she healed from surgery.

"We were hoping that the rods would allow her to walk. She not only walks now, she runs. The rods have been our best friend," said Jacki.

A'lee received physical therapy to help her gain strength and be able to walk. She still receives Pamidronate treatments every three months and visits Beaty in clinic once every six months.

A'lee will need new rods every three to four years as she grows, but so far the rods are working. It's been more than one year since her surgery, and she has only had one fracture, and that was because she jumped off the kitchen counter – a typical kid accident, says Jacki.

"We used to hold our breath every time she fell. Now, she can do what other kids her age do. She is in a normal classroom and does PE. She will try anything, and she's been like that since day one."



post-op



Research, Publications and Presentations

Le Bonheur Children's Hospital and Campbell Clinic's five surgeons are actively involved in research and presentations in the pediatric orthopaedic field. Highlights from their work are listed below:

Publications

Murphy RF1, Gibulas AM, Sawyer JR, Spence DD, Kelly DM. Levels of Evidence in the Journal of Pediatric Orthopaedics: Update and Comparison to the Journal of Bone and Joint Surgery. *J Pediatr Orthop*. 2014 Nov 19. [Epub ahead of print]

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Presentations

Jim Beaty, MD

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Beaty, Thompson, Kelly, Rush, Warner, Spence, Moisan, Sawyer. Intra and Inter-Observer Reliability and the Role of Fracture Morphology in Classifying Femoral Shaft Fractures in Children (poster). European Pediatric Orthopaedic Society, Belgium, April 2014.

Beaty James H. MD, Ryan Murphy BS, Derek M. Kelly MD, William C. Warner Jr. MD, Alice Moisan RN, Norfleet Thompson MD, David D. Spence MD, Jeffrey R. Sawyer MD. Transverse Femoral Shaft Fractures are a Better Predictor of Non-Accidental Trauma than Spiral Fractures in Young Children(poster). European Pediatric Orthopaedic Society, Belgium, April 2014.

Beaty James H. MD, Byron F. Stephens MD, Jeffrey R. Sawyer MD, William C. Warner MD, David D. Spence MD, Alice A. Moisan BSN and Derek M. Kelly MD. Interleukin-6 in Pediatric Musculoskeletal Infection: A Pilot Study (Podium). European Pediatric Orthopaedic Society, Belgium, April 2014.

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Beaty James H. MD, Byron F. Stephens MD, Jeffrey R. Sawyer MD, William C. Warner MD, David D. Spence MD, Alice A. Moisan BSN and Derek M. Kelly MD. Interleukin-6 in Pediatric Musculoskeletal Infection: A Pilot Study accepted e poster. POSNA, Hollywood, Ca., April-May 2014.

Beaty J. Advocacy for Orthopaedic Surgeons. IPDS. December 4-7, 2013. Lake Buena Vista, Fla.

Beaty J. Case Presentations. IPDS. December 4-7, Lake Buena Vista, Fla.

Beaty J. Slipped capital femoral epiphysis: Update. Pediatric Orthopaedics: Common Conditions and the Pediatric Hip. Le Bonheur, November 2, 2013.

Beaty J. Frequently missed upper extremity fractures. Pediatric Orthopaedics: Common Conditions and the Pediatric Hip. Le Bonheur, November 2, 2013.

Beaty J. Sports Injuries in Children and Adolescents: 2013 Update. Etteldorf Symposium 2013, Le Bonheur, May 2013.

Beaty J. The Orthopaedic Lecture: Basics. AAOS Annual Meeting, Chicago, Ill. March 2013.

Beaty J. The Orthopaedic Lecture: Effective Delivery. AAOS Annual Meeting, Chicago, Ill. March 2013.

Beaty J. Developing Leadership Through Orthopaedic Organizations. AAOS Annual Meeting, Chicago, Ill. March 2013.

Beaty J. The Kids You See on Call: Slipped Capital Femoral Epiphysis. AAOS Annual Meeting, Chicago, Ill. March 2013.

Beaty J. Child Abuse: Nonaccidental Injury. AAOS Annual Meeting, Chicago, Ill. March 2013.

Beaty J. Management of the Multiply Injured Child. AAOS Annual Meeting, Chicago, Ill. March 2013.

Beaty J.H., Warner, W.C., Sawyer, J.R., Kelly, D.M., Larsen, Moisan, Witte, Elzey. *Medial Unlar Collateral Ligament Origin on the Medial Epicondylar Apophysis in the Skeletally Immature Elbow: An MRI Anatomical Study*. Presented at the American Academy of Orthopaedic Surgeons, Chicago, Ill., March 2013.

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Beaty J.H., Warner, W.C., Sawyer, J.R., Spence, D., Kelly, D.M., Pretell, Murphy, Moisan. *Surgical Treatment of Symptomatic Accessory Navicular in Children and Adolescent: Is Simple Excision Enough?* ePoster presented at POSNA annual meeting, Toronto, Ontario, May 2013.

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Beaty J., Spence, D., Stranch, E., Miller, J., Kelly, D.M., Sawyer, J.R., Warner, W.C. *Retrospective chart and x-ray review of Intramedullary Nailing of Pediatric Femur Fractures in Children Less Than Twelve Years of Age*. Presented at Pediatric Orthopaedic Society of North America, Denver, Colo., May 2012.

Beaty J., Brey, J., Conoley, J., Canale, S.T., Warner, W.C., Kelly, D.M., Sawyer, J.R. *Tibial tuberosity fractures in adolescents: is a posterior metaphyseal fracture component a predictor of complications?* Presented at Pediatric Orthopaedic Society of North America, Denver, Colo., May 2012.

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William C. Warner Jr, MD

Warner, Beaty J, Bert, Biggers, Moisan, Sawyer, Kelly. Fracture of the Medial Humeral Epicondyle in Children: A Comparison of Operative and Nonoperative Management (accepted Podium). American Academy of Orthopaedic Surgeons, New Orleans, March 2014.

Warner, Beaty, Thompson, Kelly, Rush, Spence, Moisan, Sawyer. Intra and Inter-Observer Reliability and the Role of Fracture Morphology in Classifying Femoral Shaft Fractures in Children (poster). European Pediatric Orthopaedic Society, Belgium, April 2014.

Warner William C. Jr, MD, Robert F. Murphy, MD, Austin R. Davidson, BS, Derek M. Kelly, MD, David D. Spence, MD, and Jeffrey R. Sawyer MD. Sub-axial Cervical Spine Injuries in Children and Adolescents (e poster). European Pediatric Orthopaedic Society, Belgium, April 2014.

Warner William C. Jr, MD, Beaty James H. MD, Ryan Murphy BS, Derek M. Kelly MD, Alice Moisan RN, Norfleet Thompson MD, David D. Spence MD, Jeffrey R. Sawyer MD. Transverse Femoral Shaft Fractures are a Better Predictor of Non-Accidental Trauma than Spiral Fractures in Young Children accepted podium. POSNA, Hollywood, Ca., April-May 2014.

Warner William C. MD, Beaty James H. MD, Byron F. Stephens MD, Jeffrey R. Sawyer MD, David D. Spence MD, Alice A. Moisan BSN and Derek M. Kelly MD. Interleukin-6 in Pediatric Musculoskeletal Infection: A Pilot Study (Podium). European Pediatric Orthopaedic Society, Belgium, April 2014.

Warner William C Jr, MD, Beaty James H, MD, Juan Pretell-Mazzini, MD, Vinayak Perake, MD; Derek M. Kelly, MD, Jeffrey R Sawyer, MD, Alice A Moisan, BSN, David D Spence, MD. Outcomes And Complications Of Tibial Tubercle Fractures Within The Pediatric Population. A Systematic Review Of The Literature (e-poster). European Pediatric Orthopaedic Society, Belgium, April 2014.

Warner William C. Jr, MD, Beaty James H. MD, Ryan Murphy BS, Derek M. Kelly MD, Alice Moisan RN, Norfleet Thompson MD, David D. Spence MD, Jeffrey R. Sawyer MD. Transverse Femoral Shaft Fractures are a Better Predictor of Non-Accidental Trauma than Spiral Fractures in Young Children accepted podium. POSNA, Hollywood, Ca., April-May 2014.

Warner William C. Jr, MD, Robert F. Murphy, MD, Austin R. Davidson, BS, Derek M. Kelly, MD, David D. Spence, MD, and Jeffrey R. Sawyer MD. Sub-axial cervical spine injuries in children and adolescents accepted e poster. POSNA, Hollywood, Ca., April-May 2014.

Warner William C. MD, Beaty James H. MD, Byron F. Stephens MD, Jeffrey R. Sawyer MD, David D. Spence MD, Alice A. Moisan BSN and Derek M. Kelly MD. Interleukin-6 in Pediatric Musculoskeletal Infection: A Pilot Study accepted e poster. POSNA, Hollywood, Ca., April-May 2014.

Warner, Moisan, Kelly, Sawyer. The Use of VEPTR for Treatment of Congenital Scoliosis without Fused Ribs (podium). ICEOS 2013, Nov 21-22, San Diego, CA.

Warner, W. Avulsion injuries about hip and pelvis: Update Pediatric Orthopaedics: Common Conditions and Pediatric Hip. Le Bonheur, November 2, 2013.

Warner, Murphy, Moisan, Kelly, Sawyer. The Use of VEPTR for Treatment of Congenital Scoliosis without Fused Ribs (podium). American Academy of Pediatrics 2013, Orlando, FL, Oct 26-29, 2013.

Warner Jr WC, Flynn JM, Ramirez N, Pretell JA, Kelly DM, Sawyer JR. Variability of Cobb Angle and Spine Height Measurements in Non-Amblulatory Myelodysplastic Children. *Clinical Orthopaedic Society*, Buffalo, NY, Sept. 19-21, 2013.

Warner Jr WC, Perake V, Pretell JA, Moisan A, Kelly DM, Spence DS, Sawyer JR (2013) The Use of Tissue Expanders in Patients with Early Onset Scoliosis Treated with VEPTR. *Clinical Orthopaedic Society*, Buffalo, NY, Sept. 19-21, 2013.

Warner, Murphy, Moisan, Kelly, Sawyer. The Use of VEPTR for Treatment of Congenital Scoliosis without Fused Ribs (podium). SRS 2013 Lyon, France Sept 18-21.

Warner, W. Occipitocervical fusion using a contoured rod and wire construct in children: a reappraisal of a vintage technique. (podium) NAASS 2013 Naples, FL July 31-Aug 3.

Warner W. Pediatric Hip: Orthopaedic review course. AAOS Annual Meeting, Chicago, ILL March 2013.

Warner, W.C., Sawyer, J.R., Kelly, D.M., Rush, Scott, S. *Magnetic Resonance and Computed Tomography Roles in Spondylolysis Diagnosis*. ePoster presented at the American Academy of Orthopaedic Surgeons, Chicago, Ill., March 2013.

Warner, W.C., Sawyer, J.R., Kelly, D.M., Beaty, J.H., Larsen, Moisan, Witte, Elzey. *Medial Unlar Collateral Ligament Origin on the Medial Epicondylar Apophysis in the Skeletally Immature Elbow: An MRI Anatomical Study*. Presented at the American Academy of Orthopaedic Surgeons, Chicago, Ill., March 2013.

Warner, W.C., Sawyer, J.R., Kelly, D.M., Beaty, J.H., Larsen, Moisan, Witte, Elzey. *Medial Unlar Collateral Ligament Origin on the Medial Epicondylar Apophysis in the Skeletally Immature Elbow: An MRI Anatomical Study*. Poster presented at POSNA annual meeting, Toronto, Ontario, May 2013.

Warner, W.C., Sawyer, J.R., Kelly, D.M., Rush, Scott, S. *Magnetic Resonance and Computed Tomography Roles in Spondylolysis Diagnosis*. ePoster presented at POSNA annual meeting, Toronto, Ontario, May 2013.

Warner, W.C., Sawyer, J.R., Spence, D., Kelly, D.M., Beaty, J.H., Pretell, Murphy, Moisan. *Surgical Treatment of Symptomatic Accessory Navicular in Children and Adolescent: Is Simple Excision Enough?* ePoster presented at POSNA annual meeting, Toronto, Ontario, May 2013.

Warner, W.C., Astur, N., Flynn, J.M., Goltzbecker, M., van Bosse, H.J., Hoashi, J.S., d'Amato, C.R., Moisan, A., Kelly, D.M. *The Efficacy of VEPTR in Treating Patients with EOS and TIS and Arthrogyposis*. Presented at International Meeting at POSNA annual meeting, Toronto, Ontario, May 2013.

Warner, W.C., Astur, N., Flynn, J.M., Goltzbecker, M., van Bosse, H.J., Hoashi, J.S., d'Amato, C.R., Moisan, A., Kelly, D.M., Sawyer, J.R. *The Efficacy of Rib-Based Distraction with VEPTR in Treatment of Early Onset Scoliosis in Patients with Arthrogyposis*. Presented at XIV Brazilian Spine Society, Florianopolis, SC, Brazil, April 27 – 30, 2013.

Warner, W.C., Kelly, D.M., Astur, N., Gabrick, K., Muhlbauer, M.S., *Occipitocervical fusion using a contoured rod and wire construct in children: a reappraisal of a vintage technique*. Presented at XIV Brazilian Spine Society, Florianopolis, SC, Brazil, April 27 – 30, 2013.

Warner, W.C., Cannon, Astur, Kelly, Sawyer. *Characterization of Radiation Exposure in Early Onset Scoliosis Patients Treated with the Vertical Expandable Prosthetic Titanium Rib*. ePoster presented at XIV Brazilian Spine Society, Florianopolis, SC, Brazil, April 27 – 30, 2013.

Warner, W.C., *Occipitocervical fusion in children using wires and Luque rod construct: a 20-year review*. Presented at the American Society of Pediatric Neurosurgeons, February 2012.

Warner, W.C., Astur, N., Flynn, J.M., Goltzbecker, M., Van Bosse, H.J., Hoashi, J.S., d'Amato, C.R., Moisan, A., Kelly, D., Sawyer, J.R., *The Efficacy of VEPTR in Treating Patients with EOS and TIS and Arthrogyposis*. Presented at International Meeting on Advanced Spine Techniques, Istanbul, Turkey, Summer 2012.

Warner, W.C., Sawyer, J.R., Kelly, D. M., Murphy, R. *Case report of 2 subjects with broken SCFE screws*. Presented at the American Academy of Pediatrics, New Orleans, La., October 2012.

Warner, W.C., Beaty, J., Brey, J., Conoley, J., Canale, S.T., Kelly, D.M., Sawyer, J.R. *Retrospective chart and x-ray review of Intramedullary Nailing of Pediatric Femur Fractures in Children Less Than Twelve Years of Age*. Presented at Pediatric Orthopaedic Society of North America, Denver, Colo., May 2012.

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WCWarner, PKlimo, NASTur Neto, MMuhlbauer (2012) "Occipitocervical Fusion Using a Contoured Rod and Wire Construct in Children: A Reappraisal of a Vintage Technique" American Society of Pediatric Neurosurgeons, JNS: Pediatrics

Jeffrey R. Sawyer, MD

Sawyer, Warner, Beaty, J, Bert, Biggers, Moisan, Kelly. Fracture of the Medial Humeral Epicondyle in Children: A Comparison of Operative and Nonoperative Management (accepted Podium). American Academy of Orthopaedic Surgeons, New Orleans, March 2014.

Sawyer, Beaty, Thompson, Kelly, Rush, Warner, Spence, Moisan. Intra and Inter-Observer Reliability and the Role of Fracture Morphology in Classifying Femoral Shaft Fractures in Children (poster). European Pediatric Orthopaedic Society, Belgium, April 2014.

Sawyer Jeffrey R. MD, Beaty James H. MD, Ryan Murphy BS, Derek M. Kelly MD, William C. Warner Jr. MD, Alice Moisan RN, Norfleet Thompson MD, David D. Spence MD, Jeffrey R. Sawyer MD. Transverse Femoral Shaft Fractures are a Better Predictor of Non-Accidental Trauma than Spiral Fractures in Young Children(poster). European Pediatric Orthopaedic Society, Belgium, April 2014.