Children's Mercy KANSAS CITY

DELIVERING COMPREHENSIVE PEDIATRIC ORTHOPEDIC CARE

A MESSAGE FROM Richard M. Schwend, MD, FAOA, FAAP

Interim Chair, Department of Orthopedic Surgery and Musculoskeletal Science

The Department of Orthopedic Surgery and Musculoskeletal Science at Children's Mercy Kansas City is one of the largest programs in the country in a free-standing pediatric hospital, embracing a multidisciplinary collaborative approach that puts children first. We are well known for innovations in adolescent idiopathic scoliosis management strategies, sports medicine, hand surgery and a wide range of complex surgical treatments.

We are also continuing to build innovative care programs to meet our patients' needs. Most notably, we have recently added two new faculty members. Caleb Grote, MD, PhD, will head our adolescent and young adult pediatric hip preservation program, and John Krumme, MD, will lead our new orthopedic oncology and arthroplasty programs. Both will provide our pediatric patients with exceptional care not otherwise available in our region.

We also continue to strengthen our research profile by participating in prospective and retrospective research and registries that are helping lead the way to better orthopedic treatments and therapies.

One of those research efforts is a novel project through our new Children's Mercy Research Institute known as Genomic Answers for Kids. Through this project, we can nominate patients diagnosed with rare diseases for genomic sequencing. Children with common conditions such as scoliosis and hip dysplasia are also being nominated, and our surgical staff is obtaining tissue, with parental consent, during elective surgery for this study. This unique work will allow us to one day query this database in the search for answers regarding who is impacted by these conditions, and most importantly, why.

Here, we highlight some of the exciting advances made at Children's Mercy in the past year, advances which will continue to further the care we provide our pediatric orthopedic patients.

2021 HIGHLIGHTS

BEST CHILDREN'S HOSPITALS U.S.News WORLD REPORT ORTHOPEDICS 2021–22

Ranked #31 in Orthopedics by U.S. News & World Report.

Our Level 1 Pediatric Trauma Center has received verification from the American College of Surgeons (ACS), becoming **the only ACS-verified Pediatric Level 1 Trauma Center between St. Louis and Denver** and one of about 50 such freestanding centers in the country.

We routinely nominate patients diagnosed with scoliosis, osteogenesis imperfecta, osteochondritis dissecans, developmental hip dysplasia, clubfoot and other suspected genetic bone diseases as candidates for **Genomic Answers for Kids**. This unique program systematically employs an advanced set of genomic tools to uncover a greater number of inherited mutations in these patients.

The Accreditation Council for Graduate Medical Education (ACGME) and the Pediatric Orthopedic Society of North America both approved the **Pediatric Orthopedic Fellowship** at Children's Mercy. Our first fellow started in August 2021.

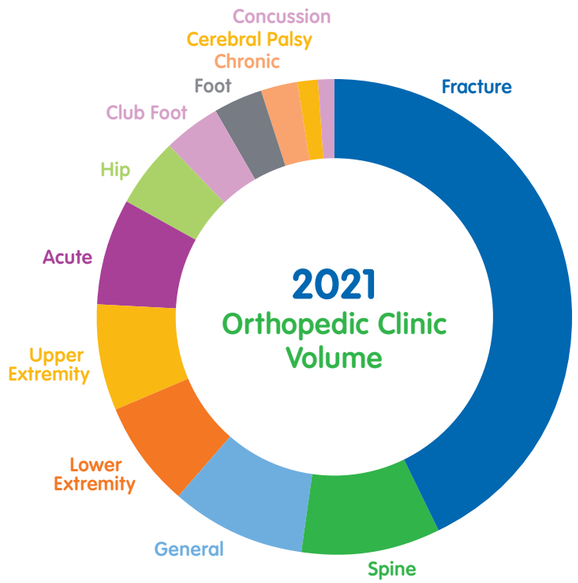
2021 HIGHLIGHTS continued

The orthopedic surgeons at Children's Mercy participate in the **Research in OsteoChondritis of the Knee (ROCK) collaborative**. This organization consists of 18 pediatric hospitals from across the United States devoted to the investigation of etiology, diagnostic criteria, management and optimization of physical activity for patients with OCD. Kevin Latz, MD, Chief, Section of Sports Medicine, represents the Children's Mercy team with this group.

The **Play Healthy KC podcast** features pediatric-trained specialists from the Children's Mercy Sports Medicine Center who discuss comprehensive care techniques for student-athletes — including training, mental therapy and nutrition — so they can be better prepared for a lifetime of sport participation.

2021 By the Numbers

40,842 outpatient clinic visits
2,812 surgeries/procedures



20 faculty
- **14** surgeons
- **6** musculoskeletal medicine physicians

22 nurse practitioners
3 physician assistants
15 physical therapists
32 athletic trainers

CLINICAL OUTCOMES

94% compliance with the preoperative antibiotic prophylaxis timing

0.79% SSI rate following spinal fusion for scoliolis

CLINICAL EXCELLENCE SETTING NEW STANDARDS OF CARE IN ORTHOPEDICS

Hip Preservation Program

Caleb Grote, MD, PhD, has joined Richard Schwend, MD, FAOA, FAAP, Lisa Berglund, MD, and the Department of Orthopedic Surgery and Musculoskeletal Science to develop a comprehensive hip preservation program at Children's Mercy.

Dr. Grote's primary patient population is focused on pediatric patients diagnosed with hip dysplasia, femoral acetabular impingement and slipped capital femoral epiphysis (SCFE) deformity.

Dr. Grote, as well as Dr. Schwend, perform periacetabular osteotomies (PAOs), surgical hip dislocations and a variety of complex hip osteotomies. Dr. Grote also is conducting research into pediatric trauma and hip pathology.

Pediatric Orthopedic Oncology Program

John W. Krumme, MD, brings his expertise and training in pediatric orthopedic oncology to the Department of Orthopedic Surgery and Musculoskeletal Science.

Dr. Krumme is developing a program to care for patients diagnosed with bone cancers such as Ewing sarcoma and osteosarcomas. He utilizes endoprosthetic replacements for limb salvage, streamlining the care provided for patients and their families at Children's Mercy.

In addition to limb salvage surgery for oncology patients, he also performs total hip and knee arthroplasties for patients diagnosed with hip arthritis, juvenile rheumatoid arthritis, and tumor resections for children diagnosed with benign bone tumors.

ACS Trauma Verification "Highest Level of Trauma Care"

The Children's Mercy Pediatric Trauma Center recently received verification from the American College of Surgeons (ACS), making it the only Level I ACS-verified Pediatric Trauma Center between St. Louis and Denver and one of about 50 freestanding such centers in the country.

Patient working with Children's Mercy physical therapist, Julianne Perrini, DPT, ATC

Key to verification was the expertise and commitment of the hospital's pediatric orthopedic trauma team, which includes Mark Sinclair, MD, Trauma Program Liaison; and Caroline Tougas, MD, Trauma Program Associate and one of the few dedicated Orthopedic Trauma Association fellowship-trained pediatric orthopedic surgeons in the nation.

The rigorous standards within the ACS verification process demonstrate that Dr. Sinclair and Dr. Tougas are providing the highest quality of care for children and adolescents admitted with complex high-energy injuries. These injuries are often caused by multiple vehicular accidents, all-terrain vehicles and firearms. The program also has a dedicated trauma room, providing timely access for patient care 24/7, and offers comprehensive services, reducing the risk of complications and leading to better patient outcomes.

LEADING THE WAY Through Research

2021 By the Numbers

23 published manuscripts

7 published book chapters

61 total presentations, including:

- **16** international and national presentations
- **14** invited lectures

8 faculty hold leadership positions in international, national and local industry and advocacy organizations

RESEARCH

28 retrospective IRB-approved studies

10 prospective studies

7 approved registries

Donna Pacicca, MD, examines patient knee

Osteocyte Research

Donna Pacicca, MD, Associate Professor of Orthopedic Surgery at the University of Missouri-Kansas City School of Medicine and Physician-Scientist, Children's Mercy Kansas City, in collaboration with Emily Farrow, PhD, Children's Mercy Genome Center, have devised a reliable method for isolating primary human bone cells using deidentified discarded healthy juvenile bone obtained from routine pediatric orthopedic surgeries.

The researchers have subsequently harvested the isolated primary cells for transcriptome analysis utilizing a novel technique called single-cell RNAseq to identify not only which genes are being expressed overall, but to identify different populations of bone cells and their functions.

Though bone cell research utilizing human pediatric bone and this specific method of analysis are still in its infancy, the potential implications are promising.

With Dr. Pacicca as the physician-scientist dedicated to leading these investigations, and Dr. Farrow providing the genetic expertise, Children's Mercy has committed the scientific team and technology necessary to process these pediatric bone samples from healthy children.

The long-term goal is to collect tissue from enough patients to determine commonalities and differences in children who have orthopedic conditions.

Twenty-two Years of Pediatric Musculoskeletal Firearm Injuries: Adverse Outcomes for the Very Young

Journal of Orthopedics

Children's Mercy researchers published a study addressing the risk for adverse outcomes in pediatric firearm-related musculoskeletal injuries that may lead to poor quality of life due to chronic health burden.

The retrospective analysis focused on firearm-related musculoskeletal injuries treated at Children's Mercy from 1995 to 2017. During that 22-year timeframe, 189 children were identified and evaluated in two cohorts: age < 10 years and age ≥ 10 years. Adverse outcomes were seen in 52 children (27.5% of total group), with 23.1% of those 10 years or older having an adverse outcome; and 41.3% of those under age 10 years old. Those below 10 years of age were more likely to be female (28.3%, P=0.018). A total of 11 (5.8%) had a spinal cord injury and 38 (20.1%) had a serious nerve injury. Other adverse outcomes included three late deaths, seven amputations, 17 with a growth disturbance and 44 with a long-term disability.

African Americans represented 60.8% of the total patient population, with 54.3% of those below 10 years of age and 62.9% in those 10 years and above of age (P=0.044). Over 90% of the population lived in a metropolitan area, with 91.3% of those below 10 years and 95.1% of those 10 years and above (P=0.467).

This markedly greater percentage of over 60% of those injured being African American needs to be further studied in a prospective registry. Redlining of housing dates back to 1933 when the federal government established the Homeowner's Loan Corporation (HOLC) to expand home ownership during the Great Depression. This redlining resulted in unequal housing opportunity and distribution of wealth and community resources, segregated neighborhoods, structural racism and other social determinants of health disparity which are causative factors in the unequal risk of Black children being injured or killed by firearm violence.

Our department has made a commitment through our research to better understand and study these social determinants of the health of our children. A prospective data registry will help us in this endeavor.

Patient healing from firearm injury

RESEARCH HIGHLIGHTS

Musculoskeletal Education: An Assessment of the Value of the American Academy of Pediatrics Musculoskeletal Boot Camp Course in Improving Clinical Confidence of Pediatricians Managing Common Musculoskeletal Conditions

Clinical Pediatrics

Richard M. Schwend, MD, FAOA, FAAP, helped author a paper on the establishment of an annual Musculoskeletal (MSK) Boot Camp by the American Academy of Pediatrics Section on Orthopedics course to fill the gaps in MSK knowledge, performance and outcomes for pediatricians and primary care doctors. A standardized one-day curriculum of key MSK topics was developed including short lectures, hands-on workshops, debates, live webinars and Q&A sessions.

A survey was created to evaluate attendee confidence related to diagnosing 20 common MSK conditions in children and adolescents at the beginning and end of the course. Confidence in diagnosing the conditions was gauged using a 6-point Likert-type scale. A two-sample test was used to compare the overall confidence score pre- and post-seminar. In addition, each subtopic was analyzed. The average pre-seminar confidence score was 3.9 versus 4.9 post-seminar. All categories demonstrated a statistically increased confidence score post-seminar ($P < .0001$). Live MSK continuing education for pediatricians was effective in improving confidence in clinical practice.

An Intraoperative Laterally Placed Distractor for Gradual Load Sharing Correction of Severe Spastic Neuromuscular Spinal Deformity

Spine Deformity

Richard M. Schwend, MD, FAOA, FAAP, and John T. Anderson, MD, performed a study analyzing the overall deformity correction for severe neuromuscular scoliosis using laterally placed intra-operative distraction and compared them to those receiving standard surgical technique.

This was a retrospective, IRB-approved cohort of patients with GMFCS 4 or 5 spastic cerebral palsy with neuromuscular scoliosis, age greater than 10 years, who underwent posterior spinal fusion from 2007 to 2019. All patients had vectored cervical traction with Gardner-Wells tongs, with hips flexed in a relative sitting position. The study cohort underwent intraoperative, laterally placed correction using a distractor placed between two upper ribs and the ipsilateral greater trochanter while the control cohort group did not. The 24 study patients were compared to 22 control patients.

The study concluded the use of a laterally placed distraction device from upper ribs to ipsilateral greater trochanter allowed gradual lateral unbending of large stiff neuromuscular spine deformities with greater correction than that of standard technique. The technique allowed load-sharing during correction, with hips remaining in a functional sitting position and without neurological complications.

Long-term Reoperation Rate for Cubital Tunnel Syndrome: Subcutaneous Transposition Versus In Situ Decompression

Hand

Micah Sinclair, MD, contributed to this study comparing the long-term revision rate of in situ ulnar nerve decompression with anterior subcutaneous transposition surgery for idiopathic cubital tunnel syndrome.

The study was a retrospective, multicenter cohort study comparing patients who underwent ulnar nerve surgery with a minimum five years of follow-up. The primary outcome studied was the need for revision cubital tunnel surgery. In total, there were 132 cases corresponding to 119 patients. The cohorts were matched for age and comorbidity.

The study reported in the long-term follow-up that in situ decompression is seen to have a statistically significant higher reoperation rate compared with subcutaneous transposition.

Genomic Answers for Kids

What role does genetics play in conditions like osteochondritis dessicans (OCD), adolescent idiopathic scoliosis (AIS) or even human bone development and response to treatment?

Genomic Answers for Kids (GA4K), a novel project at Children's Mercy Kansas City, is systematically employing an advanced set of genomic tools to uncover a greater number of inherited mutations in patients with rare diseases and their families.

The program's goal is to collect the genomic data and health information of 30,000 children and their families over the next seven years, creating a database of nearly 100,000 genomes. The Department of Orthopedic Surgery and Musculoskeletal Science has been the largest contributor of tissue to the project to date.

Using an established protocol and a REDCap database that notifies the genomics team when an orthopedic patient is scheduled for surgery, families are approached regarding consent for tissue collection during surgical procedures. The tissue collected includes bone, cartilage, muscle and skin. Previously, this tissue was discarded or sent to pathology for analysis.

Once collected, the tissue is sequenced, generating a tremendous amount of data that can then be accessed and queried by the orthopedic surgeons, as well as other researchers. In most cases, the orthopedic surgeons are enrolling patients who represent tier II populations. These are patients who have multifactorial diseases, like AIS, hip dysplasia, clubfoot and OCD. These tissue samples can be extremely helpful in determining gene expression.

For example, OCD tissue samples from more than 500 patients will be sequenced as part of Genomic Answers for Kids. The goal is to determine if there is a possible genetic connection that may one day identify the defect and better inform treatment options. Likewise, the department's spine surgeons are nominating AIS patients and children with other spine conditions for the project, collecting tissue for analysis.

If you are interested in nominating a patient for Genomic Answers for Kids, please call (816) 915-4200, email GA4K@cmh.edu, or visit childrensmercy.org/genomicanswers.

Genomic Answers for Kids Advances Rare Disease Research

The Children's Mercy Research Institute has released more than 2,300 pediatric rare disease genomes through its Genomic Answers for Kids (GA4K) program, which makes it one of the largest pediatric rare disease whole genomic datasets ever publicly shared.

To date, more than 3,700 patients have enrolled in the program, which has resulted in more than 18,000 new genomic analyses and more than 600 genetic diagnoses. In addition, the program has advanced research genomic analyses for children of 350 families with more common childhood diseases: cerebral palsy and Down syndrome.

The full pediatric data repository is shared in a real-time web interface through a comprehensive process, which gives researchers and clinicians low-barrier access to processed data with disease prioritized genetic changes.

"Giving access to our data allows researchers to link their own genetic findings so they can accept or reject hypotheses on their gene discoveries," said Tomi Pastinen, MD, PhD, Director, Genomic Medicine Center, Children's Mercy Kansas City. "Data sharing is the only way we'll make headway in the quicker delivery of results that are non-diagnostic today."

The GA4K program has helped hundreds of kids, like Celia, find a genetic diagnosis.

MEET THE TEAM

LEADERSHIP

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LEARN MORE ABOUT THE DEPARTMENT OF ORTHOPEDIC SURGERY AND MUSCULOSKELETAL SCIENCE.

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