



Heart Institute 2023 Annual Report



Children's Hospital Colorado
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A letter from leadership

Friends of the Heart Institute,

We extend our warmest greetings to you all as we embark on the inaugural edition of the Heart Institute's annual report. It is with great pride and a deep sense of gratitude that we reflect on the remarkable accomplishments of the last year.

As we commemorate the milestones of 2023, we do so with a profound sense of appreciation for our extended Heart Institute family. From former faculty and fellows with whom we love to stay connected, to our esteemed referral partners who entrust us with the care of their patients, to the courageous patients and families who place their trust in our hands, and to our generous donors whose support fuels our mission, each of you plays an integral role in our collective success.

This annual report serves as more than just a compilation of facts and figures; it is a testament to the spirit of collaboration and innovation that defines us. Within its pages, you will find a celebration of our shared accomplishments, a glimpse into the heartwarming stories that shape our journey, and a reaffirmation of our commitment to excellence.

Throughout the report, we will highlight the pivotal moments, breakthroughs and advancements that marked 2023 as a year of growth and progress for the Heart Institute. From the introduction of new faculty and fellows who bring fresh perspectives and expertise to our team, to the research and program spotlights that illuminate our pursuit of cutting-edge care, to the community events that bring us closer to those we serve, each section reflects the breadth and depth of our impact.

As we embark on this journey together, we invite you to join us in celebrating the achievements of the Heart Institute and in reaffirming our shared commitment to the well-being of every heart in our care. Together, let us continue to inspire hope, foster healing and transform lives.

With deepest gratitude,



JIM JAGGERS, MD

*Chair of Congenital Cardiac Surgery, Co-Director, Heart Institute,
Children's Hospital Colorado*



SHELLEY MIYAMOTO, MD

*Chair of Pediatric Cardiology, Co-Director, Heart Institute,
Children's Hospital Colorado*

By the numbers

58

Pediatric cardiologists

4

Pediatric cardiac surgeons

28

Advanced practice providers

56

Cardiac beds

5

Dedicated cardiac procedural suites

20

Outreach locations across Colorado and beyond

In 2023

35,452

Electrocardiograms performed

25,773

Echocardiograms performed

823

Exercise stress tests performed

22,914

Clinic visits

1,819

Fetal echos

673

Cardiac MRIs

736

Cardiac surgeries

442

Cardiopulmonary bypass surgeries

851

Cardiac catheterizations

243

Electrophysiology procedures

2,223

Adult Congenital Heart Disease Program visits

17

Heart transplants

Faculty and fellows

Passing the baton



For 21 years, Dunbar Ivy, MD, expertly led both Children's Hospital Colorado's Heart Institute and the Section of Cardiology within the Department of Pediatrics of the University of Colorado. His invaluable contributions during that time have shaped the Heart Institute into the international leader it is today across an extensive spectrum of clinical and research areas. At the close of 2022, Dr. Ivy stated his intentions to step down as the section head, and after an extensive nationwide search in 2023, he was thrilled to pass the baton of leadership to our very own Shelley Miyamoto, MD. Dr. Miyamoto transitioned into her new role as Co-Director of the Heart Institute and Section Head of Cardiology in December 2023.

It is with sincere gratitude that we thank Dr. Ivy for his years of service and share the wonderful news that he will continue within the Heart Institute as a mentor, researcher and the leader of the section's Pulmonary Hypertension Program, which was the first multidisciplinary program for children of its kind in the United States and has been treating children with pulmonary hypertension for 25 years.

Dr. Miyamoto has been a key member of our faculty since completing her pediatric cardiology fellowship at the University of Colorado in 2005. Before coming to Children's Colorado, she completed her medical degree at the University of Iowa and her pediatric residency at Brown University and Rhode Island Hospital, where she served as Chief Resident. She has most recently served as the Director of the Cardiomyopathy Program and holds the Jack Cooper Millisor Chair in Pediatric Heart Disease and now the Selby Chair in Pediatric Cardiology. She focuses on basic and translational research, with an emphasis on the study of dilated cardiomyopathy and congenital heart disease. The National Institutes of Health (NIH) continuously funds her lab, including through several institutional and foundation awards. Dr. Miyamoto has mentored more than 40 trainees, students and junior faculty within her tenure.

New faculty

The Heart Institute is thrilled to report that eight physicians and one advanced practice provider joined the Heart Institute in 2023, greatly increasing our ability to serve our growing cardiac population.



Emily Downs, MD, Congenital Cardiac Surgery

Dr. Downs is a cardiothoracic surgeon specializing in the care of children and adults with congenital heart disease. She joins the Heart Institute from Children’s Hospital of The King’s Daughters in Norfolk, Virginia and the UVA Health Children’s. As an undergraduate student, she attended the University of Michigan, where she studied oboe performance and biomedical engineering. She attended medical school at the University of Virginia School of Medicine and completed her residency there in adult cardiothoracic surgery. Dr. Downs completed her training with a fellowship in congenital cardiac surgery at Children’s Hospital Colorado. She looks forward to caring for congenital heart disease patients across the age spectrum and pediatric patients with acquired heart disease. Her clinical research interests include exploring clinical outcomes for congenital heart surgery through the lens of equity, as well as device design and surgical simulation for cardiac surgery trainees.



Robin Klein, MD, Cardiac Critical Care

Dr. Klein joined Children’s Colorado in the Heart Institute’s cardiac intensive care unit (CICU). She came from Children’s Hospital Los Angeles, where she served as an attending physician in cardiac critical care and as a staff physician for the critical care transport team. She was also an assistant professor of clinical pediatrics at the University of Southern California. Previously, Dr. Klein completed her residency in pediatrics at University of California, San Francisco. After residency, she worked as a pediatrician building pediatric care capacity at Klinik Timoun Nou Yo, the only pediatric health and medical center located in southwest Haiti. After returning to the United States, she completed a fellowship in pediatric critical care at Boston Children’s Hospital, and her fellowship in pediatric cardiac critical care at Children’s Hospital Los Angeles. Her interests include quality improvement through multidisciplinary projects, increasing pediatric cardiac critical care capacity globally through education and mentorship, and growing healthcare leaders through leadership education.



Priya Misra, MD, Colorado Springs Cardiology

Dr. Misra joined the Heart Institute as the newest provider at the Colorado Springs Outpatient Cardiology Clinic. With an interest in preventive cardiology, she also acts as the local lipid specialist at the Lifestyle Medicine Clinic. She earned her medical degree at the Renaissance School of Medicine at Stony Brook University, her general pediatrics residency training at the Maria Fareri Children’s Hospital in Westchester, New York, and stayed for an additional year as chief resident. Dr. Misra then completed her fellowship in pediatric cardiology at Children’s National Hospital in Washington, D.C. She is passionate about narrative medicine and medical education, as well as outreach and community-based medicine. Her research interests include qualitative medicine, medical humanities and medical education.



Jessica Persson, MD, Cardiac Critical Care

Dr. Persson joined the Heart Institute as a cardiac intensivist in the CICU after completing fellowships in pediatric cardiology and pediatric critical care medicine as well as a pediatric residency at Children’s Colorado. Jessica was born in Sweden and grew up in northeast Ohio. She earned her medical degree at Northeast Ohio Medical University in 2015. Seeking more sunshine than Scandinavia and Ohio could offer, she moved to Denver for her pediatric residency and has called it home ever since. Her nonclinical medical interests include medical education and point-of-care ultrasound.



Anne Taylor, MD, Interventional Cath

Dr. Taylor is a congenital interventional cardiologist who joined the Heart Institute after completing her medical training (pediatrics, cardiology and interventional cardiology) at Stanford University. She attended medical school at the University of Colorado School of Medicine and is now an assistant professor. Dr. Taylor has an interest in pre- and post-surgical evaluation of complex pulmonary artery disease in the Cardiac Catheterization Lab. In addition to her clinical work, she is interested in using novel imaging tools such as computed tomography to quantify the distribution of pulmonary blood flow in patients with pulmonary artery stenosis, as well as using new immune profiling tools to measure patients’ response to foreign surgical material.



Kevin Pettit, MD, Cardiac Acute Care

Dr. Pettit joined the Heart Institute as a hospitalist in the cardiac progressive care unit (CPCU) after a three-year pediatric cardiology fellowship at Children’s Colorado. When not on the hospital floor, he can be found staffing the cardiology clinic at Denver Health, and he enjoys providing education to learners as a University of Colorado School of Medicine assistant professor of pediatrics. Kevin completed medical school at the University of Iowa Carver College of Medicine and his pediatric residency at the University of Wisconsin School of Medicine and Public Health.



Trevor Williams, MD, Non-invasive Imaging, Fetal Cardiology

Dr. Williams is an assistant professor at the University of Colorado School of Medicine and an attending pediatric cardiologist at Children’s Colorado with a subspecialization in advanced cardiac imaging. He earned his medical degree at Johns Hopkins University School of Medicine and subsequently completed residency training in pediatrics at the Boston Combined Residency Program affiliated with Harvard University and the University of California, San Francisco before serving as an attending primary care pediatrician with academic affiliation. He then completed a pediatric cardiology fellowship and an additional year of advanced imaging training at the Children’s Hospital of Philadelphia and contributed as a member of the valve imaging team within the Topolewski Pediatric Heart Valve Center. At Children’s Colorado, he works with the cardiac imaging and fetal cardiology teams to advance 3D-image-derived modeling capabilities in service of patients with congenital heart disease.



Kanika Mathur, MD, General Cardiology

Dr. Mathur joined the Heart Institute as an outpatient cardiologist at Children’s Hospital Colorado’s Anschutz Medical Campus, North Campus locations and outreach sites. She completed medical school at Saint Louis University, followed by residency and fellowship at Albert Einstein College of Medicine/Children’s Hospital at Montefiore. She went on to practice general cardiology and imaging at Mount Sinai and Bronx Care in New York City. She joined Children’s Colorado as an assistant professor at the University of Colorado School of Medicine. Her clinical interests include community and outreach education and medical care.



Hanna Roberts, AC-PNP, DNP, Inpatient APP

Roberts is a board-certified pediatric cardiac intensive care nurse practitioner who joined us from Boston Children’s Hospital as an inpatient advanced practice provider in the CICU. Her clinical and research interests lie in palliative care in the CICU. She received her Bachelor of Science in Nursing and her Doctor of Nursing Practice from the University of Florida. Roberts is an instructor of pediatrics at the University of Colorado School of Medicine.

Honors



Michael Schaffer, MD

After 39 incredible years with Children’s Colorado, the esteemed cardiologist and electrophysiologist Michael Schaffer, MD hung up his stethoscope and no longer reads EKGs at all hours of the day or night. The shoes he left are as enormous as his legacy, and his professional legacy extends to children, families, students, residents, fellows, nurses, advanced practice providers and physicians.

Dr. Schaffer is perhaps the proudest of two main areas of his career — teaching and expanding cardiac outreach care across the region. He holds the distinction of being the only provider within the section of Cardiology to have won the Department of Pediatrics’ Career Teaching Scholars Award (2010). Nominated by his peers and selected to receive the award by a prestigious group of past awardees, Dr. Schaffer was recognized as a gifted teacher who has made an outstanding contribution to pediatric education over his career. Dr. Schaffer was also selected by pediatric residents for the Gary Way Excellence in Teaching Award (2012). Notably, he was also one of the earliest to expand cardiology’s outreach services to children and families in neighboring states in the 1980s. To this day, we provide clinical care and/or partner with referring cardiologists in Wyoming, Montana, New Mexico, Idaho, North and South Dakota, Kansas, Nebraska and Texas.

For these and many other reasons, we are proud to announce that Dr. Schaffer was granted the rank of professor emeritus following his departure in August 2023. We thank him for 39 years of outstanding contributions to the hospital, university, fields of cardiology and electrophysiology, and our students in a variety of capacities. His colleagues note his considerable impact on many aspects of Children’s Colorado and the University of Colorado School of Medicine, and we all look forward to continued collaboration in his emeritus position.



Graduated and current cardiac fellows



The pediatric cardiology fellowship program was established in 1971 and is fully accredited by the American Medical Association, the American Board of Pediatrics and the Accreditation Council of Graduate Medical Education. The collaboration between the University of Colorado School of Medicine and Children’s Colorado allows us to offer world-class training for pediatric residents and fellows.

While it is never easy to say goodbye upon graduation, we are always thrilled to have equipped our fellows, learned from them, and gained new friends and colleagues along the way. We proudly share with you our 2023 fellows, and those who stayed on or joined us for the first time.

[Click here to learn more about our fellowship program.](#)

Graduated fellows (2023)

Categorical

Kevin Pettit, MD, Cardiac Critical Care

Medical school: University of Iowa Roy J. and Lucille A. Carver College of Medicine
 Residency: University of Wisconsin Madison
 Current: Cardiac Progressive Care Unit, Children's Colorado
 Assistant Professor, University of Colorado School of Medicine

Kathryn Reynolds, MD, Interventional Cardiology

Medical school: The Brody School of Medicine at East Carolina University
 Residency: Johns Hopkins All Children's Hospital
 Current: Advanced Interventional Pediatric Cardiology Fellow, UPMC Children's Hospital of Pittsburgh

Shannon Murray, MD, ACHD

Medical school: University of Wisconsin School of Medicine
 Residency: Medical College of Wisconsin and Affiliated Hospitals
 Current: ACHD fellow, Children's Colorado

Advanced

Senta Furman, MD, Cardiac Intensive Care

Medical School: University of Illinois at Chicago College of Medicine
 Residency: St. Louis Children's Hospital
 Cardiology fellowship: Seattle Children's Hospital
 Advanced fellowship: Cardiac critical care, Children's Colorado
 Current: Pediatric critical care medicine specialist, Duke Children's Hospital and Health Center
 Assistant Professor of Pediatrics, Duke University School of Medicine

Michael Nguyen, DO, Cardiac Imaging

Medical school: Chicago College of Osteopathic Medicine
 Residency: Harbor-UCLA Medical Center
 Cardiology fellowship: Pediatric cardiology
 Advanced fellowship: Advanced cardiac imaging, Children's Colorado
 Current: Pediatric Cardiologist, Phoenix Children's Hospital

Prashant Minocha, MD, Cardiac Imaging

Medical school: University of the West Indies, Trinidad
 Residency: Jackson Memorial Hospital, University of Miami
 Cardiology fellowship: New York University, Langone Health
 Advanced fellowship: Non-invasive cardiac imaging, Children's Colorado
 Current: Pediatric Cardiologist, Ochsner Health

David Harrison, MD, ACHD

Medical school: David Geffen School of Medicine at UCLA
 Residency: Children's Hospital Los Angeles
 Cardiology fellowship: Boston Children's Hospital
 Next steps: Assistant Professor, Dartmouth School of Medicine
 Affiliate Physician, Cardiology, Boston Children's Hospital

Jason Cole, MD, Heart Failure and Transplant

Medical school: University of Nebraska Medical Center
 Residency: Nationwide Children's Hospital
 Cardiology fellowship: Nationwide Children's Hospital
 Current: Pediatric Cardiologist, Children's Nebraska
 Assistant Professor, University of Nebraska College of Medicine, Division of Cardiology

Neil Venardos, MD, Cardiothoracic Surgery

Medical school: Texas Tech University Health Sciences Center
 General surgery residency: University of Colorado
 Current: Pediatric Cardiothoracic Surgeon, Texas Center for Pediatric and Congenital Heart Disease Assistant Professor, Surgery, University of Texas Austin

Raveendra Morchi, MD, Cardiothoracic Surgery

Medical school: University of Michigan
 Residency in emergency medicine: Brown University Hospital
 General surgery residency: University of California Irvine (UCI) Medical Center
 Cardiac Surgery fellowship: UCLA David Geffen School of Medicine, UCLA Medical Center
 Current: Cardiothoracic Surgeon, UCI Health Cardiovascular Center
 Clinical Assistant Professor, Cardiothoracic Surgery, UCI School of Medicine

Current fellows (2023–2024)

Categorical

Hannah Hollon, MD, 1st year

Medical school: Medical University of South Carolina
 Residency: Children's Hospital of Richmond, Virginia Commonwealth University

Umakanthan Kavin, MD, 1st year

Medical school: Charles E. Schmidt College of Medicine, Florida Atlantic University
 Residency: Internal Medicine/Pediatrics, Medical University of South Carolina

Aidan Reid, MD, 1st year

Medical school: Rocky Vista University
 Residency: Medical College of Wisconsin

Nadia Chaudhry-Waterman, DO, 2nd year

Medical school: Edward Via College of Osteopathic Medicine, Virginia Campus
 Residency: Inova Children's Hospital

Kelsey Guerins Iguidbashian, MD, 2nd year

Medical school: Creighton University School of Medicine
 Residency: University of Colorado

Benjamin A. Olsen, MD, 2nd year

Medical school: Creighton University School of Medicine
 Residency: University of Colorado

Lauren Zager, MD, 2nd year

Medical school: University of Wisconsin School of Medicine
 Residency: University of Utah
 Fellowship: University of Michigan

Samantha Ann (Kops) Holmes, MD, 3rd year

Medical school: University of Arizona College of Medicine
 Residency: University of Arizona College of Medicine

Jeffrey Michael Shuler, MD, 3rd year

Medical school: University of Missouri School of Medicine
 Residency: Cincinnati Children's Hospital

Charles Thomas Simpkin, DO, 3rd year

Medical school: Rocky Vista University of Osteopathic Medicine
 Residency: University of Colorado

Advanced

Shannon Murray, MD, ACHD

Medical school: University of Wisconsin School of Medicine and Public Health
 Residency: Medical College of Wisconsin and Affiliated Hospitals
 Cardiology fellowship: Children's Hospital Colorado

Connor Merritt, MD, Cardiac Intensive Care

Medical school: Creighton University School of Medicine
 Residency: Cincinnati Children's Hospital
 Critical care fellowship: Cincinnati Children's Hospital
 Cardiology fellowship: Children's Colorado

Natalie Soszyn, MD, Interventional Cardiology

Medical school: University of Melbourne
 Residency: Royal Children's Hospital, Melbourne, Australia
 Cardiology fellowship: Royal Children's Hospital Starship Children's Hospital, Auckland, New Zealand

Ernesto Mejia, MD, Interventional Cardiology

Medical school: American University of the Caribbean
 Residency: SUNY Downstate, Brooklyn
 Cardiology fellowship: Rainbow Babies, Children's Colorado

Nick Holzemer, MD, ACHD

Medical school: University of Minnesota
 Residency: University of Michigan, Internal Medicine/Pediatrics
 Next steps: Faculty with Children's Hospital Colorado; Assistant Professor with the University of Colorado School of Medicine

Krista Young, MD, Cardiac Imaging

Medical school: University of Texas, San Antonio
 Residency: University of Arizona
 Pediatric cardiology fellowship: University of Iowa

Charles Fraser, MD, Cardiothoracic Surgery

Pediatric Cardiothoracic Surgery Fellow
 Medical school: University of Texas Medical School at Houston
 General surgery residency: The Johns Hopkins University School of Medicine
 Cardiac surgery fellowship: University of Pennsylvania



Making statements

From seasoned professors and cardiologists to those earlier in their careers, our Heart Institute faculty are making bold scientific statements in their respective cardiac subspecialties and forging new paths in novel research. We are proud to shine a spotlight on some of our finest: Dunbar Ivy, MD, Roni Jacobsen, MD, and Shelley Miyamoto, MD.



DUNBAR IVY, MD

Pulmonary hypertension

Dr. Ivy is among a group of experts actively filling a gap in the care of patients with pulmonary hypertension associated with congenital heart disease. These patients make up an increasing proportion of the total pulmonary hypertension population, but there are currently no consensus recommendations available to primary cardiologists or pulmonary hypertension subspecialists on how to best manage this group of patients.

Dr. Ivy published a scientific statement from the American Heart Association titled, "Pulmonary Hypertension in Congenital Heart Disease" in the journal *Circulation: Heart Failure*. The statement describes the various pulmonary hypertension groups and subgroups associated with congenital heart disease, delineates imaging modalities used in patient evaluation, provides medical and surgical management considerations, highlights disparities within this population, and identifies gaps and future research needs of patients with pulmonary hypertension associated with congenital heart disease.

While there have been many advancements in the management of these patients, more research is needed to better understand the cause and pathophysiology within the many subgroups and to develop targeted drug therapies.

[Learn more](#)



RONI JACOBSEN, MD

Adult congenital heart disease

Dr. Jacobsen is among the select group of specialists who recently published a position statement in *JACC: Advances*, an open journal published on behalf of the American College of Cardiology Foundation. The statement, "Sexual Health and Well-Being in Adults with Congenital Heart Disease: An International Society of Adult Congenital Heart Disease Statement" encourages ACHD providers to provide an open, inclusive environment to discuss sexual health with their patients. This is extremely important because individuals with ACHD may experience barriers to achieving well-being in this aspect of their lives. Outcomes for people living with ACHD are improving, and it's time to go beyond discussions about mortality to those that facilitate well-being in its fullest sense. Normalizing conversations about sexual well-being is another step toward a holistic approach to quality of life. Ensuring clinicians are serving as educators, allies and advocates is one of the ways we can break down the barriers for individuals with ACHD.

[Learn more](#)



SHELLEY MIYAMOTO, MD

Cardiomyopathy

Dr. Miyamoto contributed to a scientific statement from the American Heart Association titled, "Treatment Strategies for Cardiomyopathy in Children." This statement discusses treatment strategies for pediatric cardiomyopathies, a leading cause of heart transplantation in childhood, with an emphasis on dilated cardiomyopathy and hypertrophic cardiomyopathy.

Because the mechanisms by which cardiomyopathies develop and progress in children are different than those in adults, adult therapies do not always translate to therapies that are successful in children. As a result, the statement's suggestions focus on cause-specific therapies in children for prevention and attenuation of their cardiomyopathy in addition to symptomatic treatments.

The authors cite optimization of data collection, new clinical trial designs and advancements in precision medicine as some of the ways to improve our ability to diagnose and treat cardiomyopathies in children. Finally, they emphasize the need to empower youth with cohesive transitions from child to adult care in order to achieve optimal long-term outcomes.

[Learn more](#)

Awards and accreditations

Early career awards



Pediatric Heart Network and Second Century Early Faculty Independence Award

EMILY BUCHOLZ, MD, PHD, MPH

Fetal cardiology and cardiac imaging

Dr. Bucholz received an Early Career Award from the Thrasher Research Fund. This prestigious award is given to applicants who show great potential to impact the field of children's health through medical research and is designed to help researchers in child health gain a foothold in this important area. Her project, titled, "Improving Risk Prediction of Fontan-Related Outcomes in Children with Single Ventricle Heart Disease," will be funded over two years in the amount of \$26,750.

Dr. Bucholz also received a Second Century Early Faculty Independence Award from the American Heart Association. This award supports highly promising investigators in areas of critical, emerging priority. Dr. Bucholz's project, "The Maternal-Fetal Environment and Postnatal Outcomes in Single Ventricle Heart Disease," sits at the cross-section of fetal cardiology and single ventricle heart disease and will be funded at \$300,000 over three years. Her mentors and colleagues in this endeavor are Shelley Miyamoto, MD, Bettina Cuneo, MD, Jane Newburger, MD, MPH, and Henry Galan, MD.

At the close of 2023, Dr. Bucholz was actively recruiting women with fetal single ventricle heart disease in the Colorado Fetal Care Center. This study will be the most comprehensive assessment of maternal, fetal and placental characteristics to date including social determinants of health, maternal stress and mental health, placental pathology and cord blood biomarkers.

[Click here to learn more about Dr. Bucholz.](#)



American Heart Association Career Development Award

JENNIFER ROMANOWICZ, MD

Cardiac imaging

In April 2023, Dr. Romanowicz received the American Heart Association Career Development Award in the amount of \$231,000 over three years. This award supports highly promising healthcare and academic professionals in exploring innovative questions or pilot studies that will support their future success as a research scientist. Dr. Romanowicz's project, "Identifying Novel Imaging and Serum Biomarkers of Fontan Failure: A Metabolic Approach," leverages cardiac MRI and metabolomics to dive deeper into SVHD. Her mentors, Jesse Davidson, MD, and Alex Barker, PhD, are also managing larger studies of their own.

As of August 2023, Dr. Romanowicz began enrolling 25 SVHD patients to provide blood for metabolomics and undergo various MRI sequences. She will validate the first noninvasive measure of organ-specific oxygen metabolism in a SVHD population, which will enhance mechanistic understanding of Fontan pathophysiology and can be put to immediate use clinically. She will also leverage this novel MRI test to identify serum metabolite biomarkers for Fontan failure which may be of predictive value.



K23 Grant

BENJAMIN FRANK, MD

Pulmonary hypertension and cardiac imaging

Dr. Frank was awarded a K23 grant in January 2023 by the NIH for \$860,464 over five years. The title of Dr. Frank's work is "Pulmonary Vascular Development in Single Ventricle Heart Disease: A Longitudinal Biomarker Approach." Dr. Frank credits his mentors on the project, Jesse Davidson, MD, Kika Sucharov, PhD, Alex Barker, PhD, Steve Abman, MD, and Michael DiMaria, MD.

In 2023, Dr. Frank's team finished recruiting the stage 3 portion of the longitudinal cohort. They hope to translate these findings to intervention trials specifically targeting pathways identified to be dysregulated in the coming years.



Extracorporeal membrane oxygenation (ECMO)

In 2023, Children’s Hospital Colorado’s extracorporeal membrane oxygenation (ECMO) program was again recognized as a Platinum Level Center of Excellence by the Extracorporeal Life Support Organization (ELSO). ELSO is an international nonprofit consortium of healthcare institutions, researchers and industry partners that provide support through continuing education, guidelines, original research, publications and a comprehensive registry of ECMO patient data. This award is the highest honor ELSO bestows; it recognizes the centers who demonstrate the highest commitment to evidence-based processes and quality measures, staff training and continuing education, patient satisfaction and ongoing clinical care. Platinum Level Centers of Excellence must incorporate highly developed quality initiatives and continuously review processes within their program.

Led by Medical Director Shannon Buckvold, MD, the ECMO team demonstrates day-to-day dedication, expertise, flexibility and resiliency, and they are quick to recognize each of the perfusionists, nurses, respiratory therapists, surgeons, medical and advanced practice providers, pharmacists, nutritionists, and therapists with whom they collaborate.

1 of 15

Dedicated pediatric centers designated Platinum Level Centers of Excellence

3X

Platinum Level Center of Excellence Award recipient

1 of 43

National and international ECLS centers named a Platinum Level Center of Excellence

5X

ELSO Award of Excellence recipient



Heart transplant

The Pediatric Heart Transplant Program is one of the largest and most experienced in the world —having performed more than 530 heart transplants for infants, children and teens since 1990. As leaders in the field, our heart transplant survival rates are among the best anywhere.

In 2023, the team received the Vanguard Center of Excellence Award by the Pediatric Heart Transplant Society (PHTS) — a multidisciplinary, professional and collaborative organization dedicated to advancing the science and treatment of children through the journey of heart transplantation. The award recognizes the dedication and commitment of all the team members at a participating PHTS Center who contribute to its success. Participating centers also contribute to and can draw from the Pediatric Heart Transplant Society Database, which includes more than 9,000 children who have undergone heart transplant.



Led by Medical Director Melanie Everitt, MD, the program includes a multidisciplinary team of cardiac transplant specialists and surgeons who partner with dedicated transplant pharmacists, psychologists, social workers, child life specialists and other team members to provide the best possible care for children. Post transplant, the program links patients to cardiac rehabilitative services to help them return to good health and normal childhood activities.

The Heart Transplant team collaborates closely with colleagues working in Cardiomyopathy and Heart Failure. The larger team is well on their way to one of their aims: to be recognized nationally for outcomes, service and research in the areas of cardiomyopathy, heart failure, ventricular assist support, myocardial recovery, heart failure associated with single ventricle physiology, cardio-oncology and cardiac transplantation in children.

Echocardiography and cardiovascular catheterization

Children’s Hospital Colorado is currently accredited by the Intersocietal Accreditation Commission (IAC) in more fetal, pediatric, adolescent and adult cardiovascular diagnostic testing and intervention-based procedural areas than any other children’s center accredited by the IAC. The Heart Institute’s Echocardiography and Cardiovascular Catheterization Programs both received IAC accreditation in 2023.

Echocardiography

Based on echocardiography volume, the Heart Institute’s Echocardiography Lab ranks among the largest in the country. The annual number of echocardiograms performed was more than 25,000 in 2023. Our lab is accredited in pediatric transthoracic, pediatric transesophageal and fetal echocardiology across 30 sites in our system of care. This status is a very important aspect of a reputable imaging department. The IAC utilizes a rigorous clinical peer review process to ensure that quality and safety practices are established for improved patient outcomes. Additionally, it is the only CMS-approved accrediting body that provides a clinical peer review of case studies for diagnostic quality, report accuracy and report completeness. Interim Medical Director, Dale Burket, MD, and the team are proud to have achieved the distinction.

Cardiovascular catheterization

The IAC’s cardiovascular catheterization accreditation is a means by which cardiovascular catheterization facilities can evaluate and demonstrate the level of patient care they provide. In March 2023, the Heart Institute’s cardiovascular catheterization team had their accreditation extended to the full three years across pediatric cardiovascular catheterization, complex adult congenital heart disease, structural heart interventions and valve interventions.

The team, led by Medical Director and interventional cardiologist Gareth Morgan, MD, provided more than 850 catheterization procedures in 2023. Children’s Colorado is home to one of the largest catheter-based valve programs in the U.S. with the lowest radiation doses. This program is always involved in clinical and device trials in the U.S., which means our patients have access to the most cutting-edge research, techniques and technology available. For example, the Heart Institute is home to the most highly developed 3D integrated imaging platforms and augmented reality software development program in the United States. Through these innovations, our goal is to improve patients’ heart health with fewer and less invasive procedures. The interventional cardiology program is the only fully IAC accredited pediatric congenital cardiac catheterization and electrophysiology lab in the country.





Program spotlights

Cardiac genetics enables personalized care for inherited heart conditions

Kathryn Chatfield, MD, and Jessica Stansauk, MD, are revolutionizing pediatric cardiac care with cutting-edge genetic insights. Both board-certified in pediatric cardiology and genetics, Drs. Chatfield and Stansauk use genetic testing and the expertise of genetic counselors to better understand and treat conditions like Noonan syndrome, congenital heart disease and 22q deletion syndrome. Then they devise evidence-based innovative approaches to pediatric cardiac genetics by integrating cardiac genetics into their multidisciplinary care. This allows them to create personalized patient management for their patients and their families.

Drs. Chatfield and Stansauk also work closely with Leslie McCallen, MS, CGC, the Heart Institute's dedicated genetics counselor. McCallen teaches families about genetic conditions, options for genetic testing and how genetic conditions may affect families. She is one of 20 genetic counselors at Children's Hospital Colorado, which provides the most comprehensive, in-person, pediatric genetic counseling services both in Colorado and in its surrounding states. When not counseling patients and families, McCallen serves as an assistant professor in Pediatrics in the clinical genetics and metabolism section of the University of Colorado School of Medicine.

[Click here to learn more about our cardiac genetics program.](#)

[Click here to learn more about Dr. Chatfield.](#)

Cardiac Inpatient Neurodevelopmental Care Optimization (CINCO) Program addresses neurological interventions

Children with congenital heart defects, especially those with lengthy inpatient hospital stays, are at risk for lasting neurodevelopmental delays, which can impact overall quality of life. To address this gap, researchers implemented the Cardiac Inpatient Neurodevelopmental Care Optimization (CINCO) Program, which integrates neurodevelopmental interventions seamlessly into the care of every individual and family dealing with pediatric and congenital heart disease through clinical, quality improvement and research initiatives. To create this program, Heart Institute neuropsychologist Kelly Wolfe, PhD, partnered with psychologist Sarah Kelly, PsyD, and cardiologists and researchers Sherrill Caparola, MD, Jesse Davidson, MD, and Melanie Everitt, MD, in addition to nurses, physical therapists, a speech pathologist, biostatistician and a child life program coordinator.

[Click here to learn more about this holistic approach to patient development.](#)

[Click here to learn more about the Cardiac Inpatient Neurodevelopmental Care Optimization \(CINCO\) Program](#)



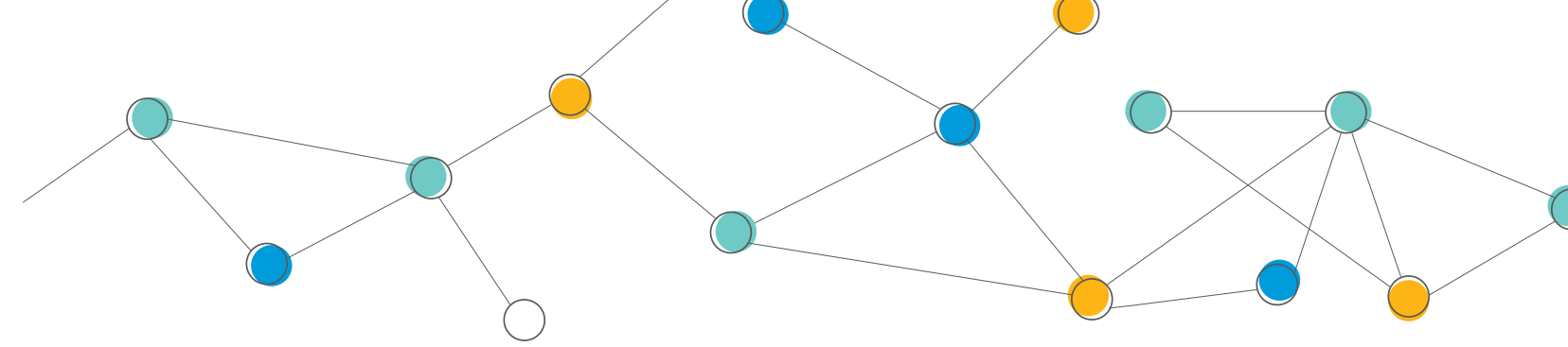
Research & innovation

Pediatric Heart Network

In 2023, Children's Hospital Colorado was accepted into the Pediatric Heart Network (PHN), a collective of leading hospitals working to improve outcomes and quality of life for children with heart disease. The Heart Institute will become one of nine clinical research centers across North America selected to be a part of this national network. Over the next seven years, the selected congenital heart centers will work together to conduct multisite research in pediatric and congenital heart disease projects, bringing even more leading and innovative trials, studies and treatments to patients treated at these sites.

Leading the new core site alongside Dr. Miyamoto is fetal cardiologist Emily Bucholz, MD, PhD, Washington University's Andrew C. Glatz, MD, and Jennifer N. Silva, MD, a professor of pediatrics and of biomedical engineering. The two centers will work together as the Gateway to the West Consortium, with regular virtual and in-person meetings, as well as a shared plan to enhance diversity in research participants and a shared mentorship model to train the next generation of pediatric cardiology clinical investigators.

[Click here to read more about the Pediatric Heart Network.](#)



Data-driven heart disease discovery

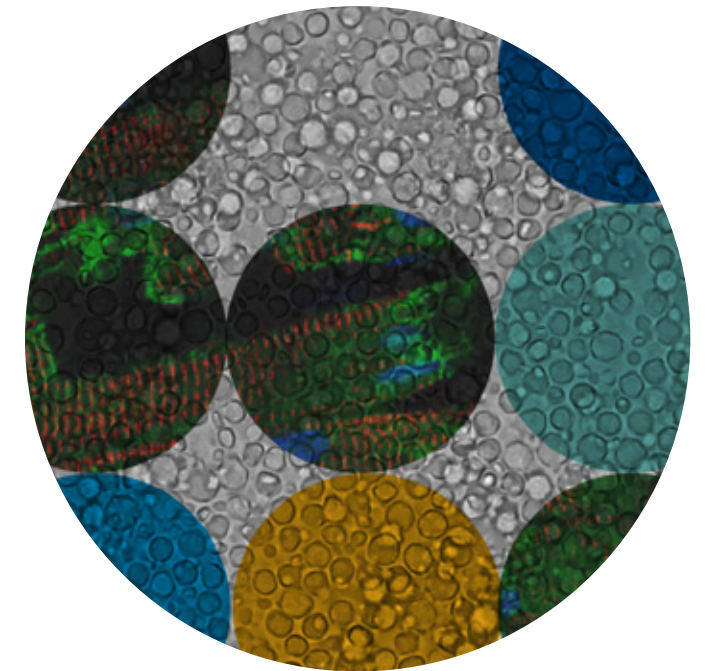
Investigators in the Heart Institute are using big data and multiomics profiling as a launchpad to uncover new information and hypotheses about pediatric heart disease. Big data analytics would not be possible without a team of experts working together across the University of Colorado (CU) Anschutz Medical Campus. For example, as part of this work, it was necessary to engage with statisticians, and CU is home to the Center for Innovative Design and Analysis — an invaluable tool for researchers partnering with biostatisticians and data scientists on complex data sets.

[Click here to learn more about how big data powers cardiac disease research.](#)

Why pediatric hearts fail

A team of doctors at the Heart Institute is working to uncover the exact mechanisms that lead to heart failure for some children after single ventricle surgery. The hope is to not only identify potential drugs to slow the progression, but ultimately prevent the need for a heart transplant all together. This area of pediatric research is particularly valuable because what we know about heart failure in adults is vastly different than what we know about heart failure in children. As Dr. Miyamoto puts it, "There's something different about pediatric heart failure," and the team at Children's Colorado is determined to figure out what.

[Click here to learn more about the Heart Institute's research.](#)





Grants



Department of Defense

Grant type: Congressionally Directed Medical Research Program, Peer Reviewed Medical Research Program, Investigator-Initiated Research Award

Title: “Cardiomyocyte Autonomous Contractility Defects in Hypoplastic Left Heart Syndrome (HLHS)”

In March 2023, Stephanie Nakano, MD, was awarded the Department of Defense’s Investigator-Initiated Research Award in the amount of \$2,391,041 over four years. This award supports research that has the potential to profoundly impact the development and implementation of medical devices, drugs and clinical guidance that will enhance the precision and efficacy of prevention, diagnosis and treatment across a wide range of disciplines, including cardiovascular health. The goal of her project is to use induced pluripotent stem cell cardiomyocytes derived from HLHS patients as a model to interrogate the myofilament phenotype in HLHS, including the effects of chronic hypoxia on contractility, and as a platform to identify HLHS-specific medical therapies. At the end of 2023, Dr. Nakano generated induced pluripotent stem cells and matured cardiomyocytes from three different patients, two with HLHS and one pediatric patient without congenital heart disease.



National Institutes of Health

Grant type: NIH Research Project Grant Program (R01)

Title: “Metabolic Profiling and Comprehensive Metabolic Pathway Mapping: a Systems Biology Approach to Cardiovascular Failure and Organ Injury Following Infant Congenital Heart Disease Surgery”

At the close of 2023, Jesse A. Davidson, MD, was in his third year of a five-year grant awarded by the NIH in the amount of \$3,144,430. The Research Project Grant (R01) is the oldest grant mechanism used by NIH and provides support for health-related research and development based on the mission of the NIH. A quarter of children with congenital heart disease undergo intervention in the first year of life, often requiring surgery with cardiopulmonary bypass. Mortality for high-risk surgeries remains greater than 10% and major complications occur in 30% of these complex surgeries. Dr. Davidson believes that novel diagnostic, mechanistic and therapeutic approaches are critically needed to reduce this burden on our infants, families and healthcare system. His study is a combined clinical cohort study and pre-clinical large animal study to determine the metabolic changes associated with cardiovascular failure and organ injury following infant cardiac surgery.



World Children's Initiative

Grant type: Project K: Legacy Grant

Title: “Virtual Reality Applications for Patients with Congenital Heart Disease”

World Children’s Initiative (WCI) created The Project K: Legacy Grant, in honor of Kanishka Ratnayaka, MD, an internationally renowned pediatric interventional cardiologist that passed away in 2021 due to colon cancer. The grant seeks to recognize and promote the work of an individual who embodies Dr. Ratnakaya’s commitment to cutting-edge research with the potential to improve healthcare access for children. In September 2023, WCI awarded the inaugural The Project K: Legacy Grant in the amount of \$39,000 to Jenny E. Zablah, MD, at Children’s Colorado. VR has been used as a tool for medical education as a procedure can be repeated unlimited times; through practice, individuals can increase their understanding of surgical and procedural processes and improve their familiarity with the tools utilized. The research team within Children’s Colorado’s catheterization laboratory has been working on VR technologies for the last three years. In this research study, they aim to evaluate the role of VR for procedural planning in four specific scenarios.



Korean Institute of Advanced Technology

Grant type: Performance Partnership Grant (PPG)

Title: “Advancement of Customized Cardiac/Cardiovascular Surgical Solutions Based on 3D Printing and Advanced Imaging”

The Korean Institute of Advanced Technology, or KIAT, is South Korea’s equivalent of the NIH. This project is a subproject of a larger one involving several departments within the University of Colorado system, of which radiologist Alex Barker, PhD, is the lead. Dr. Zablah is the primary investigator of the funded subproject. The funding is for \$700k over four years out of approximately \$2.1M in total available funding for the U.S. execution site. This project includes collaboration with academic and industry partners in South Korea. The project’s objective is to support Children’s Colorado’s efforts to perform patient-specific surgical planning using imaging and 3D printing.

Innovation in electrophysiology



Leadless pacemaker

Leadless pacemakers were developed to provide a safer alternative for patients who need their heartbeat regulated in certain situations. In July 2023, the Children's Hospital Colorado Heart Institute became one of the first pediatric teams in the world to implant the AVEIR Leadless Pacemaker. Children's Colorado's pediatric electrophysiologists Dustin Nash, MD, and Johannes von Alvensleben, MD, implanted the novel leadless pacemaker into an 18-year-old patient's heart.

[Click here to learn more about the leadless pacemaker's use in pediatrics.](#)



EV implantable cardiac device

Dr. Nash successfully performed the first implantation of an extravascular implantable cardioverter defibrillator, or EV-ICD, at a pediatric center. This minimally invasive ICD system marks a significant leap in medical technology and signals a paradigm shift in treating young patients with life-threatening cardiac conditions.

[Click here to learn more about the EV ICD.](#)

Impact in the cardiac community

Heart Institute faculty belong to many different communities depending on their subspecialties, clinical interests, research interests, academic backgrounds, hometowns, ethnicities, families of origin, neighborhoods, personal interests and hobbies. In this section, we highlight a handful of ways our providers are making a difference on international, local and individual levels.

Representation at World Congress

The Heart Institute featured prominently at the 8th World Congress of Pediatric Cardiology and Cardiac Surgery, a large international meeting of unparalleled depth, scope and size, affectionately known as "The Olympics of our Profession." Held in August 2023 in Washington, D.C., the Congress's scientific program featured conversations across the topics of pediatric cardiology, cardiac surgery, cardiac nursing, cardiac anesthesia, cardiac intensive care, perfusion and more. Heart Institute faculty moderated more than 25 talks and had over 75 faculty and team members in attendance.

Inspiring the next generation

When Ingrid Renteral was born with a rare congenital defect, a "flip-flopped" heart, she was airlifted to Children's Colorado, where doctors determined she needed surgery. Rather than pumping blood into her body, her heart was pumping it directly into her lungs. While Renteral has no memory of that surgery, or the second one before her first birthday, she remembers the many regular visits to see her cardiologist, Dr. Miyamoto, who has taken care of her since she was a baby. Fast forward 18 years, and Renteral received a full scholarship to Colorado State University, where she plans to pursue medicine.

[Click here to learn more about Ingrid's care.](#)

Outreach clinic expansion

In 2023, the Heart Institute embarked on a significant expansion initiative, introducing two new electrophysiology (EP) outreach clinics aimed at enhancing accessibility to specialized care for our patients and families across the region. Through strategic partnerships, we successfully launched a monthly EP outreach clinic in Albuquerque, New Mexico, in collaboration with the University of New Mexico. Additionally, we established an EP outreach clinic on the western slope of Colorado, in Grand Junction, further solidifying our commitment to serving diverse communities across our state. We are privileged to have the opportunity to extend our care and expertise to these regions.

Heart Institute Wellness Program

The psychosocial and developmental challenges of being diagnosed with a heart condition are sometimes overlooked in traditional medical treatment. That’s where the Heart Institute’s Wellness Program comes in. Our team of multidisciplinary experts helps patients and families find healthy ways to cope with and adapt to living with a heart condition. Our goal is to provide ideas, time, space and resources that help patients thrive while they undergo medical treatment, and long after. It takes a village, and we have one.

- Social workers help families cope with the social, financial and psychological needs associated with heart conditions.
- Child life specialists utilize therapeutic play, age-appropriate education and coping techniques to help patients and their families adjust to the hospital or clinic setting and cope with chronic illness and treatments.
- Medical dogs help comfort children and assist with treatment goals.
- Pediatric psychologists provide assessment, consultation and interventions to support overall mental health and well-being.
- Chaplains provide support to children and families of all spiritual outlooks.
- Music therapists use music to provide psychosocial, developmental, rehabilitative and physiological support to patients and their families during inpatient stays.
- Learning services specialists are trained to evaluate a child’s academic needs and provide learning support services to individuals as well as small groups of children, informed by the most current knowledge and advancements in the fields of learning and learning disabilities.

One of the best ways to heal emotionally and physically is in community. That’s why our cardiac community events are so important and so well-attended. Three of our largest events in 2023 were a family day at Cheyenne Mountain Zoo in Colorado Springs during the summer, a pumpkin patch at Anderson Farms in Erie, Colorado during the fall, and a Zoo Lights event at the Denver Zoo in early winter.

[Click here to learn more about the Wellness Program at Children’s Colorado.](#)



Cardiac Climbers

Founded in 1990, the Courage Classic is an annual, two-day cycling fundraiser that brings together riders, volunteers, sponsors, friends and families to support Children’s Colorado. Routes range from 12 to 79 miles that wind through the beautiful Rocky Mountains. Each adult rider fundraises a minimum of \$500, and all proceeds benefit the Heart Institute. The funds are used directly for research and innovation, trainee and nursing education, and to support patients and families.

In 2023, the Cardiac Climbers fielded a team of 107 riders and many volunteers, raising over \$138,000. The Cardiac Climbers’ motto is “For us, it’s personal.” And it is. These cyclists are also cardiologists, surgeons, advanced practice providers, nurses, sonographers, parents, siblings, friends and former Heart Institute patients, who all gather to tackle one of Colorado’s toughest road cycling tours, the Courage Classic.

2023 commemorated the 70th anniversary of open heart surgery at Children’s Colorado. Christel Walrath, 71 years old, underwent atrial septal defect (ASD) closure in 1953 — long before open heart surgery was regularly performed. Hailing from Laramie, Wyoming, Walrath rode both days of the Courage Classic and was able to celebrate with the team at their Saturday picnic. Today, an ASD closure is performed regularly by a noninvasive method called cardiac catheterization, a testament to the advances in research and medicine. Often, patients may even return home the next day.

Overall, the Courage Classic is the single largest fundraising event for Children’s Hospital Colorado, having raised more than \$60 million since its inception. As a nonprofit hospital, these funds are crucial to the 300,000 patients we treat annually.

How to refer



Email: Heart@childrenscolorado.org



Fax: 720-777-7377 (surgical referrals)

Fax: 720-777-7177 (all other referrals)



Phone: 720-777-5878

[Click here](#) to get a second opinion.

[How to give to the Children's Hospital Colorado Foundation](#)



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