

CONGENITAL CARDIOLOGY TODAY

Timely News & Information for Congenital/Structural Cardiologists & Cardiothoracic Surgeons Worldwide

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Uses of AI in Pediatric Cardiology ... an Occasional Column

John Moore, MD, MPH

This year at the 8th World Congress, I deviated from my usual pattern of more or less exclusively attending interventional sessions. Having not given much prior thought to uses of Artificial Intelligence in Pediatric Cardiology or Medicine in general, I decided to see what was going on in the Artificial Intelligence (AI) sessions. Wow, it was "eye-opening."

I was aware of AI being used in specific tasks, such as in analysis of medical images, alerting physicians to drug interactions and in some medical administrative tasks. New to me was the emergence of AI which has general cognitive capabilities and which may be capable of assisting users with a much wider variety of different tasks.

Released late in 2022, Chat GPT and GPT-4 are among these Als. They are Large Language Models (LLMs), which use a "prompt" as a starting point. These Als sequentially build reasonable "continuations" to previously existing texts, drawing on a huge base of digital learning (basically, everything on the internet, all digital books etc.). The completed "response" is the final result of a complex iterative process.¹ In theory, Chat GPT and its more advanced version GPT-4 may be useful in a wide variety of medical applications, including health care documentation, health data analysis, diagnosis, research and education.^{2,3}

In this piece, I consider whether GPT-4 can have a role in patient counseling. GPT-4 is available through several cell phone Apps. I downloaded an App called ChatOn-AI Chat Bot Assistant. ChatOn provides written responses to prompts from the user. A response starts to appear immediately after the prompt is sent and is completed within a few seconds.

So, can we use AI to counsel patients? I prompted ChatOn as follows: Explain the Fontan Procedure to a patient's parents. I received the following response:

The Fontan Procedure is a surgical procedure that is usually performed on children born with a specific type of congenital heart defect known as a single ventricle defect. In a healthy heart, oxygen-poor blood from the body enters the right atrium, then flows into the right ventricle, and finally gets pumped to the lungs to receive oxygen. On the other hand, oxygen-rich blood from the lungs enters the left atrium, then flows into the left ventricle, and is pumped out to the rest of the body.

However, in children with a single ventricle defect, there is only one functional ventricle instead of two. This means that the blood from both the body and the lungs mixes together, which can lead to various complications.

During the Fontan Procedure, the surgeon creates a new pathway for the blood to flow properly. They redirect the oxygen-poor blood directly from the body to the lungs, bypassing the heart. This is usually done by connecting the veins that bring the oxygen-poor blood from the body directly to the pulmonary arteries,



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which carry the blood to the lungs. This allows the oxygenrich blood from the lungs to flow back to the body without mixing with the oxygen-poor blood.

The Fontan Procedure is typically performed in stages, with the first surgery usually done in infancy, followed by additional procedures as the child grows. The goal is to improve the child's overall heart function and oxygen levels in the blood, therefore promoting healthy growth and development. It's important to keep in mind that each child's situation is unique, and the specific details of the Fontan Procedure may vary depending on the individual case. Your child's healthcare team will be able to provide you with more specific information tailored to your child's needs. I hope this explanation helps you understand the Fontan Procedure better! If you have any further questions or concerns, feel free to ask.

Subsequently, I asked ChatOn to help with the patient directly using the following prompt: *Explain the Fontan Procedure to a two-year-old patient*. Again, within a few seconds I received a response:

Hello there! I'm here to help you understand the Fontan Procedure. ☺

The Fontan Procedure is a type of heart surgery that is sometimes done for children with a single ventricle, which means they have only one working pumping chamber in their heart. This surgery is usually done when a child is around 2 to 3 years old, just like you!

During the Fontan Procedure, the doctors will create a new pathway for the blood to flow through your heart. They will do this by redirecting the blood from the lower part of your body, like your legs, to go directly to your lungs. This helps your heart work more efficiently.

To do this, the doctors will connect a tube called a conduit or a tunnel between the vein that carries blood from your lower body and the artery that takes blood to your lungs. This tube will act as a new pathway for the blood to flow.

After the surgery, your heart will be able to pump oxygenrich blood to your body without having to go through the normal two-step process. This helps your heart work better, and it can improve your energy levels and overall health.

It's important to remember that the Fontan Procedure is a complex surgery, and it requires a lot of care and support from your doctors and loved ones. But many children who have this procedure go on to live happy and healthy lives!

I hope this explanation helps you understand the Fontan Procedure a little better.

If you have any more questions, feel free to ask! 😔

Do you use AI in your practice? Would you like to discuss your methods in CCT? Please contact Dr. Moore jwmmoore1950@gmail.com

The first response is quite reasonable and likely helpful in a general way. The second is ludicrous and inappropriate. Apparently, the AI does not "know" that a two-year-old cannot understand an "explanation" of the Fontan Procedure. This gaff highlights a present weakness of LLMs, and is a reason why these AIs can only be used as tools not substitutes for humans.

Finally, I used a different more age-appropriate prompt for the patient query: *How should I prepare a two-year-old for Fontan surgery*? I received a very reasonable response:

I'm not a doctor, but I can offer some general suggestions to help prepare your two-year-old for Fontan heart surgery. Remember to consult with your healthcare provider for specific advice tailored to your child's needs. Here are a few ideas:

- Maintain a positive atmosphere: Children are perceptive and can pick up on their caregivers' emotions. Try to create a calm and reassuring environment around your child to help them feel secure.
- 2. Age-appropriate explanations: Use simple, ageappropriate language to explain the upcoming surgery to your child. You can mention that the doctors will be working on their heart to make it better. Emphasize that the doctors and nurses are there to help and keep them safe.
- 3. Books and visual aids: Utilize picture books or other visual aids that explain medical procedures or hospitals in a child-friendly manner. These resources can help your child understand what to expect.
- 4. Play pretend: Engage in imaginative play with your child using dolls or stuffed animals. Show them how the dolls go through a pretend surgery, using gentle and positive language. This can help reduce anxiety and familiarize them with the process.
- 5. Maintain routines: Try to stick to your child's regular routines as much as possible leading up to the surgery. Consistency can help provide a sense of security during this uncertain time.
- 6. Comfort items: Allow your child to bring their favorite toy or comfort item with them to the hospital. Having something familiar nearby can provide a sense of comfort and familiarity.

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USE OF AI IN PEDIATRIC CARDIOLOGY

 Talk to the medical team: Reach out to the medical team involved in your child's care. They can provide you with more specific guidance on how to prepare your child for the surgery. They may also have resources or support services available for families in similar situations.

Remember, every child is unique, so it's essential to tailor your approach to your child's individual needs. Providing love, support, and reassurance throughout the process can go a long way in helping your little one prepare for Fontan heart surgery.

From these examples, it's clear that the user has a significant challenge in employing GPT-4 as a tool. It is really a case of "Garbage in ... garbage out." Prompts must be thoughtfully crafted. The more specific and "appropriate" a prompt is, the better will be the response from the AI.

More later...

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JOHN MOORE, MD, MPH

Medical Editor Congenital Cardiology Today San Diego, CA, USA <u>jwmmoore1950@gmail.com</u>

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Journal of Pediatric Cardiology and PICS Launch a Special PICS Collection on PDA Stenting

Karim Diab, MD; Mazeni Alwi, MD; Howaida El-Said, MD

After discussions between the PICS directors, the Editor-in-Chief of Pediatric Cardiology, Springer Nature, is launching a series of PICS collections focusing on particular interventional topics in the field of Pediatric Cardiology. The aim for such collections is to provide a constellation of articles on a particular hot topic in pediatric interventional cardiology and allow researchers focusing on a particular topic to gain higher visibility. As such, **Pediatric Cardiology and PICS** have embarked on opening the first **PICS Collection** named **"PDA Stenting: Past, Present and Future."** We are pleased to announce that Dr. Alwi and Dr. El-Said are the invited guest editors for this special PICS Collection!

PDA stenting can be done for both systemic and pulmonary ductaldependent lesions. In the recent past, there has been significant focus on PDA stenting in the setting of pulmonary dependent circulation. The modified Blalock Taussig shunt (mBTS) has been the mainstay of palliation of lesions with ductal-dependent pulmonary blood flow (DD-PBF). However, even in the current era, this has been associated with post-operative instability and 30-day mortality in excess of other more technically complex neonatal operations. This has been partly attributed to a case-mix that includes more complex lesions or severely ill neonates, leading to a drive toward alternative approaches in the palliation of these neonates.

In the last decade, ductal stenting (DS) has gained wider acceptance as an alternative to mBTS. In recent publications, multicenter collaborative efforts that compared the outcomes of BTS with DS – though retrospective in nature – have validated some of the merits of DS observed in preceding single-center case series.

With our shared accumulated experience, we are seeing some degree of standardization of the PDA stenting procedure e.g. the role of pre-procedure advanced imaging, choice of vascular access, techniques and materials, post-procedure management and interstage follow-up. It is still too early, however, to say that we are at the cusp of a new era where DS will soon supplant mBT as the palliation procedure of choice. There are procedural complications that are unique to DS, and durability of palliation is a concern, although earlier definitive surgical repair has become the norm for the majority of complex cyanotic CHD. Publications on surgical experience with repairing lesions that had been palliated with DS is still a trickle. In addition, DS remains a procedure that relies fundamentally on materials borrowed from the coronary interventional world. There are certain aspects of complex PDA morphology in neonates with DD-PBF that may be better served by stents that are specifically designed for this purpose.

The Journal of Pediatric Cardiology and PICS invite experts and researchers in the field to submit original research, review article and perspectives on the topic of PDA stenting, specifically focusing on areas such as advanced imaging, procedural techniques, postprocedure care and follow-up, and surgery post DS, long term results, new stent development and work related to this subject. We particularly encourage original research papers that present new scientific findings and outcomes, as well as review papers that provide a comprehensive overview of the current state-of-art and future directions on this topic. For review papers, we encourage authors to critically evaluate and synthesize existing research, identify key gaps in knowledge or limitations in current practices, and propose innovative ideas or new directions for future research on this topic.

All submitted papers should follow the author guidelines provided on the Pediatric Cardiology journal website. During the submission, you will be asked if you are submitting your manuscript to a PICS Collection. At this time, submissions for this Collection will be open till September 2024.

General Benefits for Authors Submitting Papers to Pediatric Cardiology PICS Collections

Submitting papers to a PICS collection in Pediatric Cardiology follows the same steps as submitting a regular manuscript except specifying to submit it to a particular PICS collection during the process if the manuscript is pertinent to the topic. This has several potential benefits to the authors including:

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- 7. This gives an opportunity to promote and support young researchers in their scientific career as authors.
- 8. This possibility also provides additional opportunities for speakers/researchers at annual PICS conferences to have their original work presented.



THE PICS SOCIETY

For more information on the PICS Collection on PDA Stenting please check the journal's website, visit:

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KARIM A. DIAB, MD, FACC, FASE

Director, Fetal Heart Program Lurie Children's Hospital Associate Professor of Pediatrics Northwestern Feinberg School of Medicine Editor-In-Chief, Pediatric Cardiology, Springer Chicago, IL, USA karimdiab@gmail.com



MAZENI ALWI, MD, FPICS

Department of Paediatric Cardiology Institut Jantung Negara (National Heart Institute) Kuala Lumpur, Malaysia



HOWAIDA EL-SAID, MD, PHD

Professor Pediatric Cardiology University of California San Diego Director of Cardiac Cath Lab Rady Children's Hospital Adult Congenital Heart Disease Certified San Diego, CA, USA



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MEDICAL NEWS



Arterial Stiffness May Cause and Worsen Heart Damage Among Adolescents by Increasing Blood Pressure and Insulin Resistance

Arterial stiffness is a novel cause of premature heart damage among adolescents, according to a new follow-up study. The study was conducted in collaboration between Texas Children's Hospital and Baylor College of Medicine in the US, the University of Bristol in the UK, the University of Exeter in the UK, and the University of Eastern Finland, and the results were published in Atherosclerosis.

Left ventricular hypertrophy and left diastolic dysfunction are measures of structural and functional heart damage, which have been associated with an increased risk of cardiovascular-related death in adults. These cardiac measures are also used in the paediatric population as indicators of premature heart damage.

Arterial stiffness estimated from carotid-femoral pulse wave velocity has been discovered as a novel cause of increased blood pressure, insulin resistance, and metabolic syndrome in adolescents and young adults. It was also recently shown that increased blood pressure in adolescence may cause premature heart damage, but it is not known whether arterial stiffness could independently cause structural and functional damage to the heart.

The current study was conducted among 1,856 adolescents of whom 1,011 were female. The adolescents were 17 years old at baseline, and they were followed up for seven years until young adulthood at age 24 years. Arterial stiffness, carotid intima-media thickness, and evidence of heart damage were assessed at baseline and follow-up. Signs of heart structure damage are left ventricular hypertrophy and high relative wall thickness, whereas signs of heart function damage are left ventricular diastolic dysfunction and increased left ventricular filling pressure.

During the 7-year follow-up period, the prevalence of heart structural damage among adolescents doubled. With extensive control for: fat mass, muscle mass, glucose, insulin, blood pressure, lipids, smoking status, sedentary time, physical activity, socio-economic status, and family history of cardiovascular disease, and using adults' cut points for diagnosing heart damage, it was observed that adolescents in the highest tertile category of arterial stiffness and carotid intima-media thickness had a 23 -27% increased risk of progressively worsening structural heart damage. Only arterial stiffness appears to independently cause both structural and functional heart damage, whereas increased carotid wall thickness does not seem

to have a causal role. Increased carotid wall thickness is an early indicator of atherosclerosis, whereas increased arterial stiffness describes arteriosclerosis. The study further reported that arterial stiffness caused heart damage by increasing blood pressure and insulin resistance. The increase in blood pressure explained 34% of the heart damage caused by arterial stiffness. Moreover, insulin resistance explained 15% of the heart damage caused by arterial stiffness.

"We are seeing for the first time that arterial stiffness is a novel cause of several diseases such as: hypertension, insulin resistance, metabolic syndrome, and heart damage in the young population. Among adults, arterial stiffness is currently being established as a cause of type 2 diabetes. We discovered that approximately 50% of the deleterious role of arterial stiffness in causing heart damage is enhanced by the mechanism of increased blood pressure and insulin resistance. Thus, preventing and lowering blood pressure and insulin resistance may potentially diminish the negative impact of arterial stiffness on the heart, by up to half," says Andrew Agbaje, a physician and clinical epidemiologist at the University of Eastern

"Experimental and clinical intervention studies are urgently needed on comprehensive approaches to treating and reversing arterial stiffness from adolescence. At least, targeting blood pressure and insulin resistance leaves the problem half-solved," Agbaje continues.

Finland.

Dr Agbaje's research group (urFIT-child) is supported by research grants from Jenny and Antti Wihuri Foundation, the Finnish Cultural Foundation Central Fund, the Finnish Cultural Foundation North Savo Regional Fund, the Orion Research Foundation, the Aarne Koskelo Foundation, the Antti and Tyyne Soininen Foundation, the Paulo Foundation, the Yrjö Jahnsson Foundation, the Paavo Nurmi Foundation, the Finnish Foundation for Cardiovascular Research, Ida Montin Foundation, Eino Räsänen Fund, Matti and Vappu Maukonen Fund, and the Foundation for Pediatric Research.



Andrew Agbaje, MD, MPH

For further information, please contact:

ANDREW AGBAJE, MD, MPH

Cert. Clinical Research (Harvard), Principal Investigator (urFIT-child) Institute of Public Health and Clinical Nutrition, School of Medicine, University of Eastern Finland Kuopio, Finland andrew.agbaje@uef.fi

+358 46 896 5633

Honorary Research Fellow, Children's Health and Exercise Research Centre, Public Health and Sports Sciences Department, Faculty of Health and Life Sciences, University of Exeter Exeter, UK a.agbaje@exeter.ac.uk https://uefconnect.uef.fi/en/person/andrew. agbaje/

Link to the Article

Agbaje AO, Zachariah JP, Tuomainen TP. Arterial Stiffness but not Carotid Intima-Media Thickness Progression Precede Premature Structural and Functional Cardiac Damage in Youth: A 7-Year Temporal and Mediation Longitudinal Study. Atherosclerosis August 3, 2023. <u>https:// doi.org/10.1016/j.atherosclerosis.2023.117197</u>

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MEDICAL NEWS

Rady Children's Appoints Adel Younoszai, MD, as Rady Children's Hospital Co-Director of the Heart Institute, and Division Chief of Cardiology, Department of Pediatrics, UC San Diego

SAN DIEGO, Calif. — Rady Children's Hospital-San Diego, the largest children's hospital on the West Coast and one of the nation's top pediatric health care systems, and the University of California, San Diego (UCSD) are pleased to announce that Adel Younoszai, MD, has been appointed as Rady Children's Hospital Co-Director of the Heart Institute, and Division Chief of Cardiology, Department of Pediatrics, UC San Diego. Dr. Younoszai will spearhead the evolution of the cardiology department by embracing the technological advancements to empower providers to deliver faster, more effective care and improve outcomes.

With more than 20 years of experience in pediatric cardiology, Dr. Adel Younoszai has created both wellness and neurodevelopmental support programs – staffed by psychologists, neuro-developmental psychologists, and child life therapists – for children born with heart problems. His 12 years as a volunteer doctor at a camp for children with chronic and life-threatening heart disease strengthens his track record of treating severe forms of pediatric congenital heart disease. He takes a holistic approach to treating his patients by supporting wellness in the children and families.

"As a pediatric cardiologist by training, I've known about Dr. Younoszai and his excellent reputation for years," said Patrick Frias, MD, President & CEO of Rady Children's. "His accomplishments in clinical care, research and in leadership roles are truly impressive and we're so fortunate to have him join Rady Children's and UC San Diego." Prior to his appointment, Dr. Younoszai was the Professor of Pediatric Cardiology and Associate Dean of Clinical Affairs, Child Health at the University of Colorado School of Medicine, which allowed him the experience and insights into high level organizational alignment.

"Dr. Adel Younoszai will be a phenomenal help to our



Adel Younoszai, MD

institution by developing a great outreach program in cardiology and cardiac surgery," said Gabriel G. Haddad, MD, Distinguished Professor of Pediatrics and Neurosciences Chairman, Department of Pediatrics, University of California San Diego. "He will be a great Cardiology Chief for our institution, and he joins us at the right time. He is an expert in Echocardiography and a great teacher for medical students, residents and fellows."

Dr. Younoszai obtained his medical degree from the University of Iowa, College of Medicine, Iowa City. He completed his Master's in Healthcare Management from Harvard University's T.H. Chan School of Public Health.



MEDICAL NEWS



HeartSciences Signs Definitive Agreements with the Icahn School of Medicine at Mount Sinai to Commercialize Artificial Intelligence Cardiovascular Algorithms

Southlake, TX (GLOBE NEWSWIRE) -- Heart Test Laboratories, Inc. d/b/a HeartSciences (Nasdaq: HSCS; HSCSW) ("HeartSciences" or the "Company"), an AI-powered medical technology company focused on transforming ECGs/EKGs to save lives through earlier detection of heart disease, today announced it has executed definitive agreements with the Icahn School of Medicine at Mount Sinai (Icahn Mount Sinai), in New York, NY, to commercialize electrocardiographic AI algorithms and assets, as well as a memorandum of understanding for on-going cooperation, collaboration and de-identified data access.

Icahn Mount Sinai has invested in the curation of tens of millions of ECG records, enabling its leading researchers to develop a range of disease detection algorithms and state-of-the art AI foundational methods for use with ECG waveforms. HeartSciences has entered into licenses covering rights to a variety of Icahn Mount Sinai's AI algorithms, technologies and patent filings for the screening and diagnosis of cardiovascular disease.

HeartSciences and Icahn Mount Sinai have also entered into a memorandum of understanding for ongoing cooperation encompassing de-identified data access, on-going research, and the evaluation of HeartSciences' MyoVista® wavECGTM.

"We are thrilled to announce this agreement with Icahn Mount Sinai and look forward to working with one of the top-ranked hospitals for cardiology in the world, at the cutting edge of AI-powered ECG development," said Andrew Simpson, CEO of HeartSciences. "This is a transformative event for the Company and will significantly strengthen our business, accelerate our development and broaden the range of prospective solutions that we will provide for patients.

In addition to providing algorithms on our MyoVista device we also intend to develop a cloud-based, device agnostic platform to enable HeartSciences to provide AI-solutions to help identify cardiovascular disease in any care setting worldwide in a manner to best suit different care providers."

Girish Nadkarni, MD, MPH, Irene and Dr. Arthur Fishberg, Professor of Medicine at the Icahn School of Medicine at Mount Sinai. System Chair of the Division of Data-Driven and Digital Medicine (D3M), Co-Director of the Mount Sinai Clinical Intelligence Center (MSCIC), and the Co-Director of the Charles Bronfman Institute of Personalized Medicine said, "Cardiovascular disease is the leading cause of death around the world, with over 20 million fatalities annually. Accordingly, early detection and treatment are of paramount importance. Al-powered ECG analysis offers the potential of achieving these goals, potentially reducing healthcare costs and improving patient quality of life. Icahn Mount Sinai is a leader in this developing field, having assembled a world class team of researchers led by Akhil Vaid, MD, Instructor in the Division of Data Driven and Digital Medicine (D3M), and invested in the curation of data for millions of ECG records with our Scientific Computing Infrastructure. We are delighted to enter into this agreement with HeartSciences and look forward to a close relationship and bringing these important technologies to market."

Erik Lium, PhD, the Chief Commercial Innovation Officer of the Mount Sinai Health System and the President of Mount Sinai Innovation Partners, said, "HeartSciences is one of a small number of companies working to bring new Al-powered ECG capabilities to market. We believe that these types of technologies may enable the early detection of heart disease and improve the lives of patients."

The artificial intelligence cardiovascular algorithms are based on technology developed by Mount Sinai faculty and licensed by Mount Sinai to HeartSciences. Mount Sinai and Mount Sinai faculty, including Dr. Nadkarni; Dr. Vaid; Joshua Lampert, MD, Medical Director of Machine Learning for Mount Sinai Heart; Vivek Reddy, MD, Director of Cardiac Arrhythmia Services for The Mount Sinai Hospital and Mount Sinai Health System, and The Leona M. and Harry B. Helmsley Charitable Trust Professor of Medicine in Cardiac Electrophysiology at Icahn Mount Sinai; and Son Duong, MD, Assistant Professor of Pediatrics (Pediatric Cardiology) at Icahn Mount Sinai, have a financial interest in this technology and in HeartSciences. The financial interest of Mount Sinai faculty is pursuant to the Mount Sinai Intellectual Property Policy.

For more information, please visit:

https://www.heartsciences.com Twitter: @HeartSciences

CHIP NETWORK CONGENITAL HEART INTERNATIONAL PROFESSIONALS

MEETING CALENDAR

MEDICAL NEWS

DECEMBER

07^{тн}-09^{тн}

UF International Aortic Symposium Orlando, Florida, USA https://floridaaorta.cme.ufl.edu/register/

08TH-09TH

CSI Focus D-HF 2023 Wiesbaden, Germany https://www.csi-congress.org/dhf

FEBRUARY

22ND-24TH

Innovations in Heart Valve Reconstruction: A Master Class - 8th Annual Advances in Congenital Heart Disease Summit Lake Buena Vista, Florida, USA https://www.clevelandclinicmeded.com/live/courses/ congenital/

APRIL

06TH-08TH

ACC.24

Atlanta, Georgia, USA https://accscientificsession.acc.org/Registrationand-Hotels/Registration-Rates-and-Dates?utm source=direct&utm_medium=email&utm content=A24085&utm_campaign=acc24

17TH-20TH

PICS-IPC Istanbul 2024 Istanbul, Turkey https://picsistanbul.com/en Mary Jane Eazer Elected to Adult Congenital Heart Association (ACHA) Board of Directors

Winter Garden, FL and Media, PA – The Adult Congenital Heart Association (ACHA) - whose mission is to empower the Congenital Heart Disease (CHD) community by advancing access to resources and specialized care that improve patient-centered outcomes – has appointed Mary Jane Eazer to its Board of Directors.

Diagnosed in one in 100 births, CHD is the most common birth defect and a chronic illness that includes a range of simple, moderate, and complex heart defects that need to be monitored throughout a patient's life. ACHA serves and supports nearly two million adults with congenital heart disease - along with their families and the medical community - with education, outreach, advocacy, and research.

Eazer spent more than 25 years as a sales and marketing leader in the medical device industry, most recently as U.S. Director for Congenital Therapies at Medtronic.

"Throughout my career, I saw firsthand the challenges of keeping CHD patients in specialized care as they get older," Eazer said. "It is critically important to raise awareness among this population and bring them back to care, a mission I will carry forward in my role with ACHA."

"Mary Jane's professional experience brings a unique perspective to our Board, as she has a deep understanding of



the complexities around getting patients on, or back on, a specialized care pathway," said ACHA President and CEO Mark Roeder. "Having engaged with cardiologists and other medical professionals in the field, she understands the need for a hyperlocal and national approach to educating patients, so they get the care they need and deserve."

As a member of the Board of Directors, Eazer joins a dedicated group of professionals, who oversee the organization's leadership and strategies in an effort to advance ACHA's mission and advocate for people living with CHD.

"ACHA has a direct, positive impact on people's lives, including my niece who is an adult living with congenital heart disease," Eazer concluded, "so my commitment to this cause is very personal. I look forward to putting my knowledge and experience to work."

For more information about ACHA, contact (888) 921-ACHA or visit <u>www.achaheart.org</u>.



CORPORATE OFFICE

PO Box 52316 Sarasota, FL 34232 USA

CORPORATE TEAM

PUBLISHER & EDITOR-IN-CHIEF Kate Baldwin kate.f.baldwin@gmail.com

FOUNDER & SENIOR EDITOR Tony Carlson tcarlsonmd@gmail.com

EDITOR-IN-CHIEF EMERITUS Richard Koulbanis CO-FOUNDER & MEDICAL EDITOR John W. Moore, MD, MPH jwmmoore1950@gmail.com

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