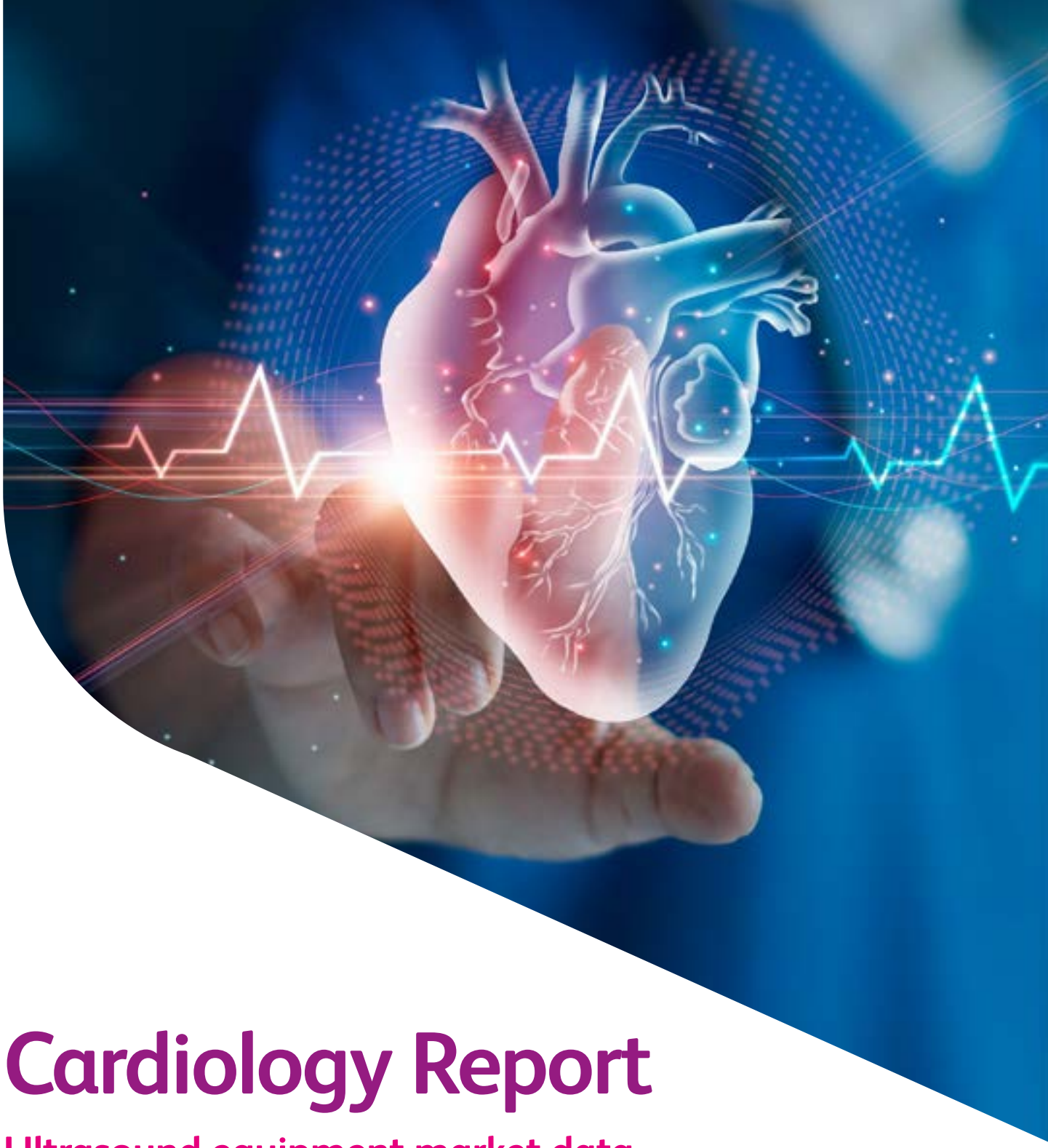


Cardiology Report

Ultrasound equipment market data and new developments in cardiology

Produced in collaboration with Omdia, part of Informa, and with the support of UCLA Health

Omnia Health
By Informa Markets

UCLA Health

Together for a healthier world

Introduction

Coronary vascular disease (CVD), including heart disease and stroke, remains the world's leading cause of death, claiming 18.6 million lives each year, according to the World Heart Federation.

While access to treatment and support for CVD varies widely worldwide, more than 75 percent of CVD deaths occur in low- to middle income countries.

Yet, advances in medical imaging technology, in addition to new surgical procedures and medical devices can help in the detection of heart disease.

The following pages deep dive into market data for ultrasound systems used by cardiologists, and recent developments in cardiology that include home-based ultrasound with AI, TAVI, and the use of ECG to detect heart failure.

This report was produced with data-driven insights provided by leading technology research company Omdia with the support of UCLA, whose 160 cardiovascular research laboratories working together with physicians and healthcare professionals design therapies and interventions to treat heart disease.

Contents

Market data for ultrasound systems

According to market analysis by Omdia, part of Informa, COVID-19 related heart ailments, combined with the high incidence of heart disease, will make the cardiology market more resilient than most dedicated equipment segments since it will likely see a spike in procedural volume.

Ultrasound systems for cardiology

Worldwide data

The market for ultrasound equipment by clinical application: World [millions of dollars]

	Base year								CAGR
Revenue	2017	2018	2019	2020	2021	2022	2023	2024	2019-24
Cardiology 2D	616.4	642.7	637.2	544.3	573.8	615.9	630.7	647.8	0.3 %
Cardiology 3D/4D	568.5	619.1	644.5	531.4	594.4	675.2	716.9	758.0	3.3 %
Interventional cardiology	159.1	170.1	172.5	134.3	151.7	174.3	182.7	191.4	2.1 %

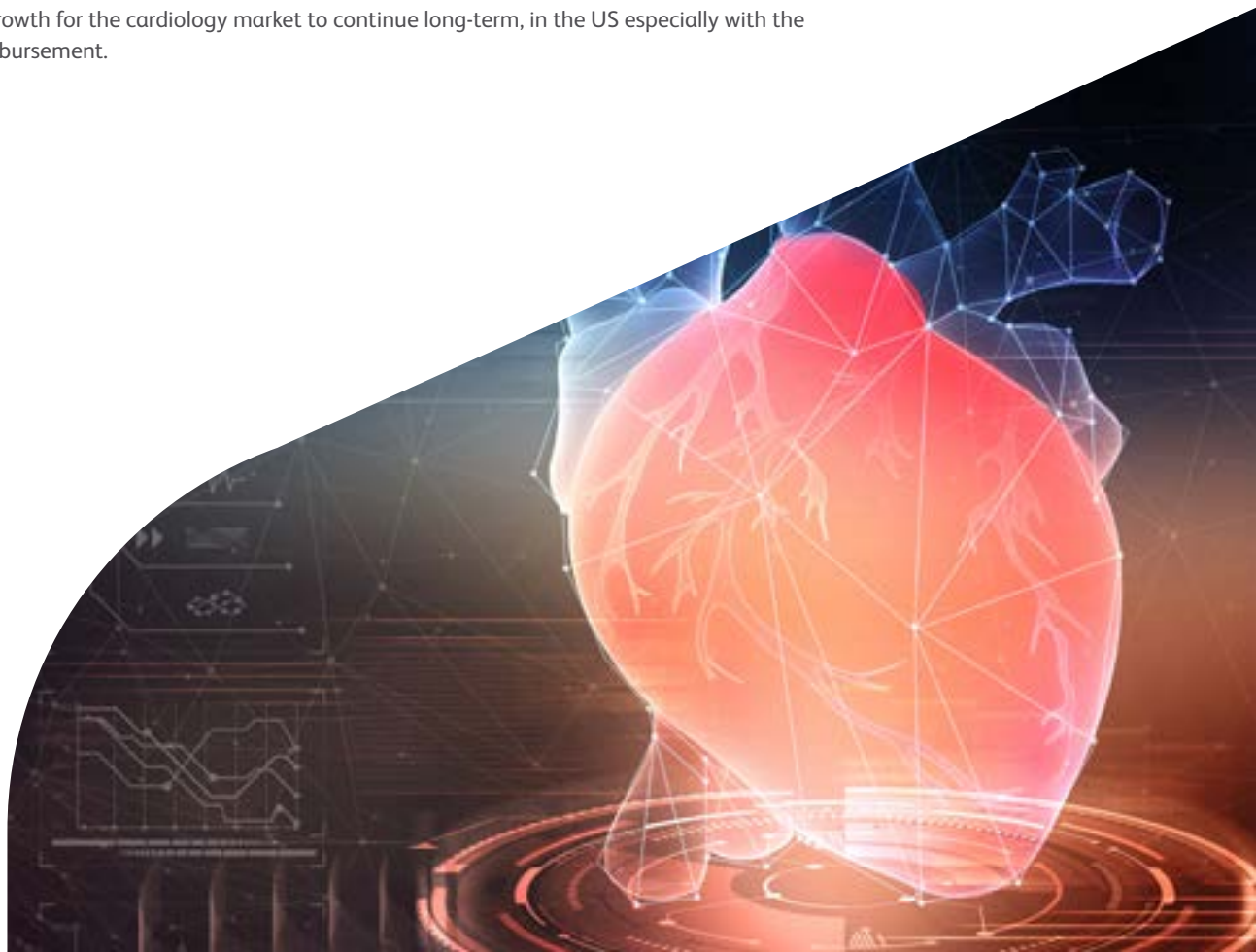
The market for ultrasound equipment by clinical application: World [units]

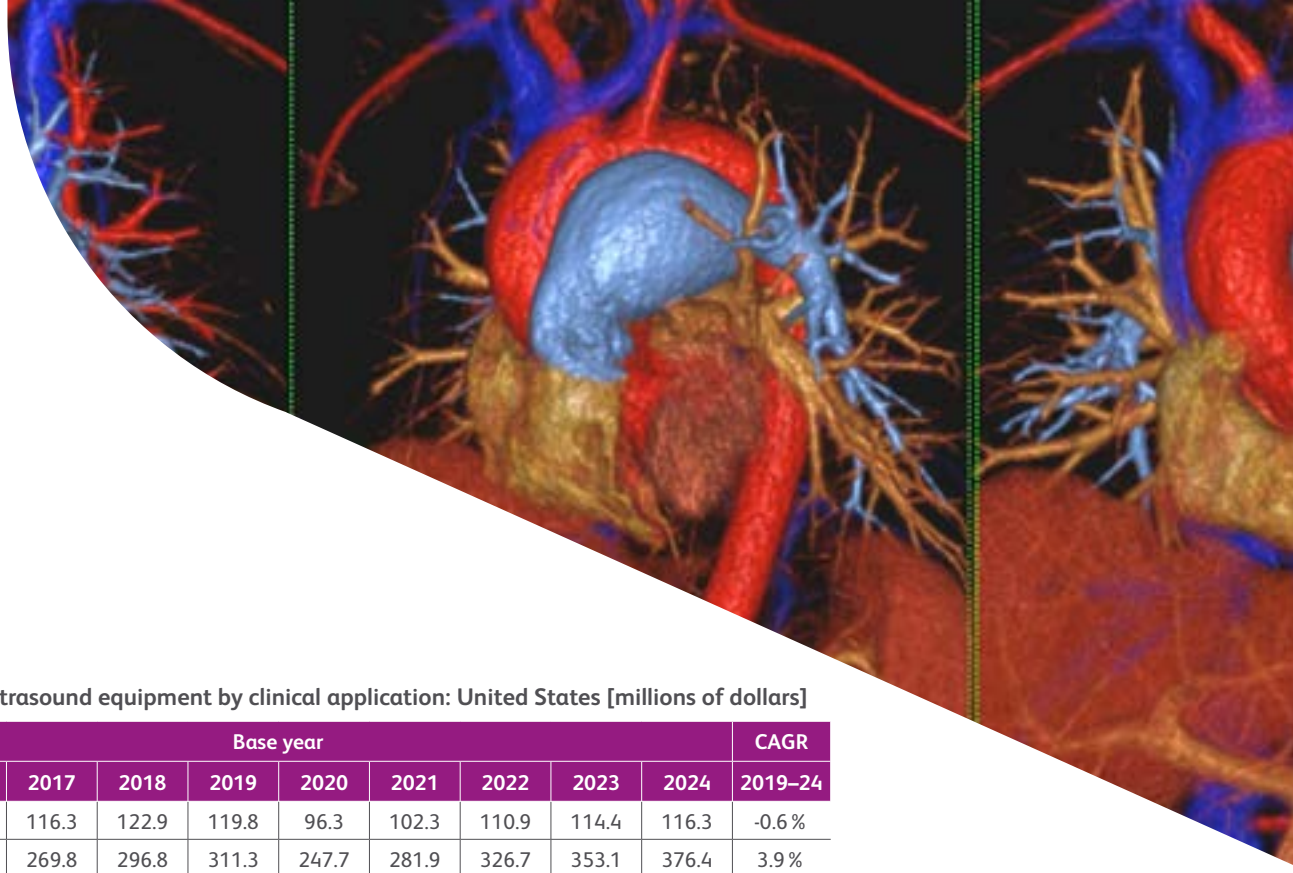
	Base year								CAGR
Revenue	2017	2018	2019	2020	2021	2022	2023	2024	2019-24
Cardiology 2D	19,028	19,257	19,135	17,794	18,901	20,086	20,758	21,541	2.4 %
Cardiology 3D/4D	5,316	6,192	6,519	6,245	7,126	8,018	8,576	9,151	7.0 %
Interventional cardiology	1,541	1,781	1,827	1,598	1,792	2,005	2,103	2,213	3.9 %

United States data

In recent years, cardiology has remained an area of focus for the **United States** healthcare system due to the high incidence of cardiovascular disease. The cardiology market, along with the OB/GYN market, shifted toward 3D/4D technology since it provides better diagnostic capabilities and is crucial in interventional procedures.

We forecast the growth for the cardiology market to continue long-term, in the US especially with the expansion of reimbursement.





The market for ultrasound equipment by clinical application: United States [millions of dollars]

	Base year								CAGR
Revenue	2017	2018	2019	2020	2021	2022	2023	2024	2019–24
Cardiology 2D	116.3	122.9	119.8	96.3	102.3	110.9	114.4	116.3	-0.6 %
Cardiology 3D/4D	269.8	296.8	311.3	247.7	281.9	326.7	353.1	376.4	3.9 %
Interventional cardiology	64.7	69.0	68.1	52.0	59.5	69.6	74.7	79.2	3.1 %

The market for ultrasound equipment by clinical application: United States [units]

	Base year								CAGR
Revenue	2017	2018	2019	2020	2021	2022	2023	2024	2019–24
Cardiology 2D	1,654	1,790	1,720	1,679	1,851	1,961	1,997	2,009	3.2 %
Cardiology 3D/4D	2,175	2,612	2,581	2,563	2,968	3,370	3,640	3,895	8.6 %
Interventional cardiology	488	564	527	483	536	588	616	640	4.0 %

China data

In **China**, cardiology shipments shifted heavily toward 3D/4D technology as healthcare providers adopted the most advanced dedicated systems. In Japan meanwhile, cardiology applications had strong growth, addressing cardiovascular diseases.

Healthcare providers have also eagerly adopted ultrasound for vascular and interventional applications since they are shown to improve patient outcomes.

The market for ultrasound equipment by clinical application: China [millions of dollars]

	Base year								CAGR
Revenue	2017	2018	2019	2020	2021	2022	2023	2024	2019–24
Cardiology 2D	57.4	69.2	65.2	59.5	64.2	69.7	73.0	76.5	3.3 %
Cardiology 3D/4D	84.2	89.9	107.4	97.0	110.2	125.6	135.2	145.7	6.3 %
Interventional cardiology	5.3	6.6	7.4	6.6	7.9	9.4	10.4	11.4	9.0 %

The market for ultrasound equipment by clinical application: China [units]

	Base year								CAGR
Revenue	2017	2018	2019	2020	2021	2022	2023	2024	2019-24
Cardiology 2D	1,724	2,158	2,172	2,250	2,520	2,782	2,995	3,219	8.2 %
Cardiology 3D/4D	713	788	999	1,035	1,215	1,393	1,532	1,678	10.9 %
Interventional cardiology	41	51	60	61	73	85	95	106	12.1 %

Case study: Groundbreaking cardiovascular research at UCLA leads to individualized care

Cardiovascular genomics at UCLA

Researchers at the UCLA cardiovascular theme are investigating and contributing to our understanding of the genetic basis of cardiac disease. Cardiovascular disease does not affect everyone the same way.

An individual's susceptibility to disease, response to treatment and likelihood of survival are partly inherited. Environmental factors (for instance, diet, exercise and whether or not the person smokes) have an impact, as well. Yet, treatment of cardiovascular disease is too often one-size-fits-all.

UCLA takes a different approach. We tailor research, care and recovery to match an individual's unique genetics and lifestyle.

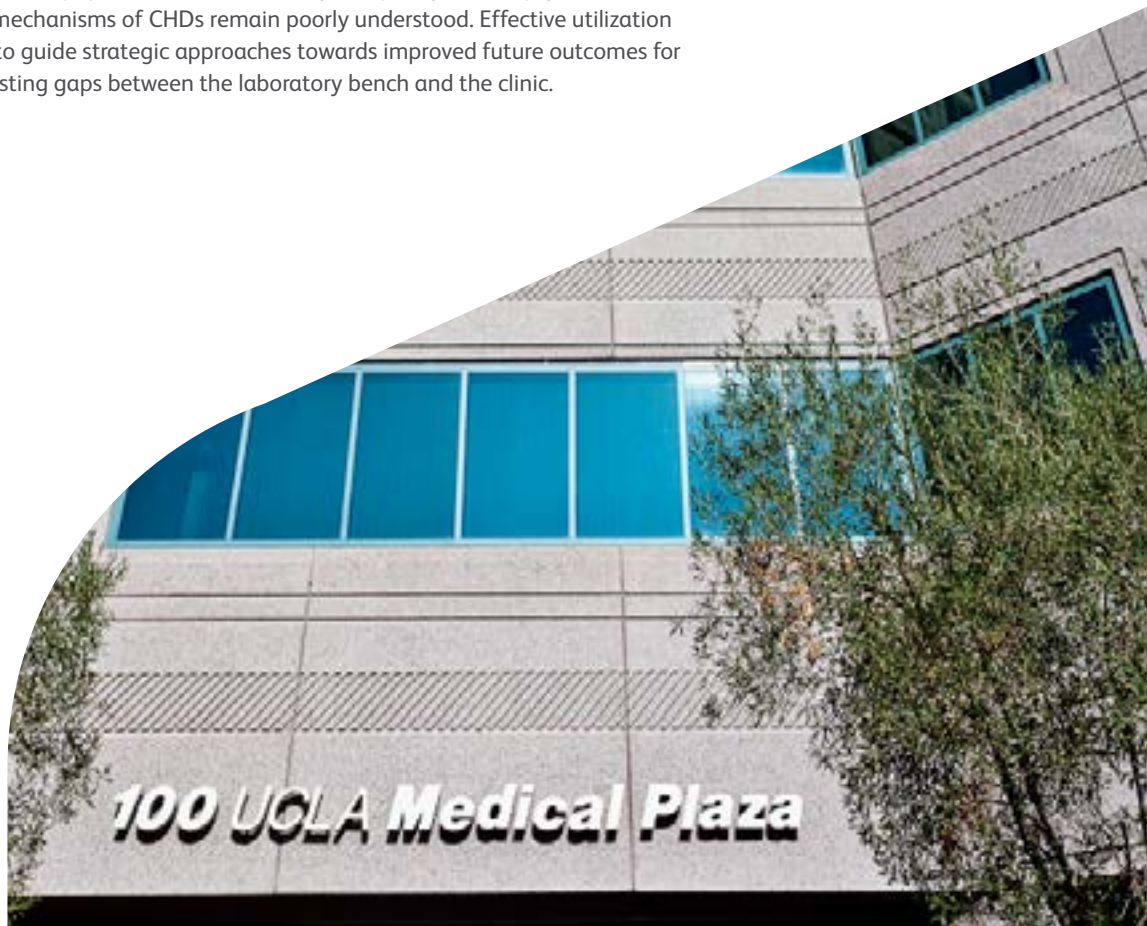
Evidence-based cardiovascular medicine

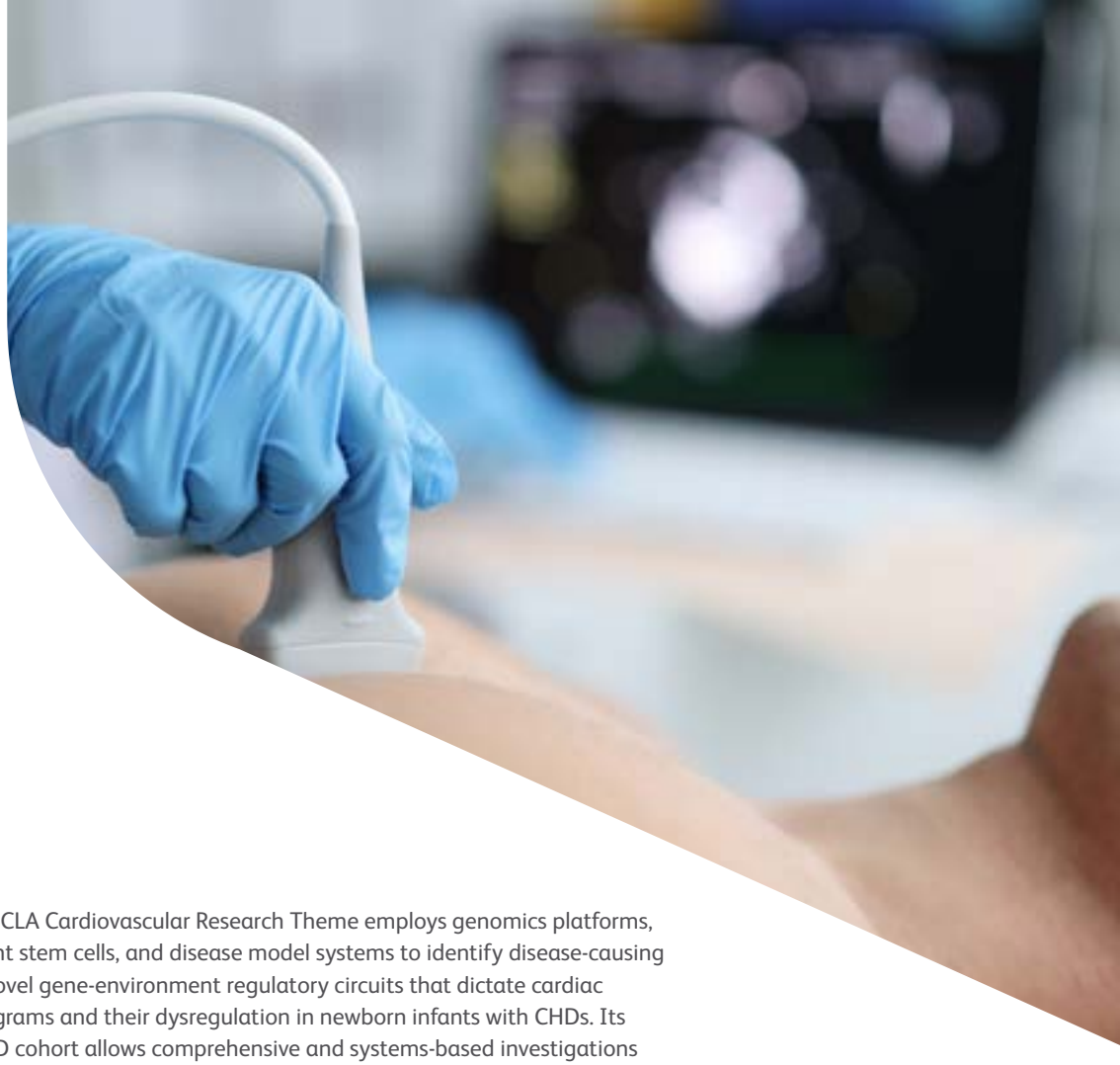
The first step toward individualized medicine is to make sure patients receive the treatment options that have already been developed and are available. UCLA has long been a leader in evidence-based medicine for cardiovascular care.

The key to success is to make sure patients are receiving the benefits of prior discoveries. Dr. Gregg C. Fonarow, Interim Chief of UCLA's Division of Cardiology, Director of the Ahmanson-UCLA Cardiomyopathy Center, and Co-director of UCLA's Preventative Cardiology Program, notes that without a system in place to make sure that happens, it can take 10 to 15 years from discovery until definitive proof that a therapy improves outcomes for patients.

Cardiovascular developmental genomics for congenital heart disease

Congenital heart disease is one of the most common forms of congenital defects (CHDs) and affects nearly 1 % of 40,000 live births in the United States annually, representing a leading cause of morbidity and mortality in pediatric population. Contributed by complex genetic, epigenetic, and environmental interactions, the mechanisms of CHDs remain poorly understood. Effective utilization of the new discoveries promises to guide strategic approaches towards improved future outcomes for CHDs, but requires narrowing existing gaps between the laboratory bench and the clinic.





To address this unmet need, the UCLA Cardiovascular Research Theme employs genomics platforms, patient derived induced pluripotent stem cells, and disease model systems to identify disease-causing genetic variants and to uncover novel gene-environment regulatory circuits that dictate cardiac development and maturation programs and their dysregulation in newborn infants with CHDs. Its unique and well-characterized CHD cohort allows comprehensive and systems-based investigations to elucidate the mechanisms of CHDs, improve the diagnostic yield of genomics platforms, and ultimately develop targeted therapies.

Precision based medicine is here to stay and forms the next frontier of providing effective therapies to all says, Dr. Arjun Deb, director of the UCLA Cardiovascular Theme. Just as the same disease may manifest itself with very different presentations in two different individuals, so can therapy. Precision medicine helps us understand who can benefit most from certain therapies or who we should be more concerned about accelerated disease progression. The UCLA Cardiovascular Theme is using emerging technologies available at UCLA to champion such individualized medicine approaches.

Individualized care in action

Today, UCLA's Adult Congenital Heart Disease (ACHD) Center is one of the largest in the United States, performing over 250 adult congenital catheterizations including interventional as well as diagnostic catheterizations, and 80 adult congenital heart disease surgical procedures. In addition, the Center has an extremely busy electrophysiology program, a transplant program, a reproductive health program, and a mental health program.

The UCLA ACHD program is unique as it consists of a wide variety of sub-specialists with expertise in all the various areas of congenital heart disease ranging from heart failure specialists, rhythm specialist, structural interventionalists, imagers, surgeons, all coming together to strive for the best possible outcomes for its patients.

The "UCLA difference" can be seen clearly when congenital interventional cardiologist and director of the Ahmanson UCLA adult congenital heart disease center, Dr. Jamil Aboulhosn, operates on an adult with a congenital heart condition.

Each patient has unique anatomical and physiological problems. Dr. Aboulhosn and his colleagues address these patients' individual situations by:

1. Using UCLA imaging technology to visualize the heart, including the use of feraheme 4-D MRI
2. Using 3-D printing to practice the procedure ahead of time
3. Partnering with basic and translational scientists to study molecular signatures of health and disease in humans

The goal is to understand how diseases arise from a combination of lifestyle and genetic factors. With this knowledge, UCLA's team of physicians, scientists, surgeons and engineers designs better strategies for preventing and curing cardiovascular disease on a patient-by-patient basis – providing truly individualized care.

UCLA Adult Congenital Heart Disease Center paving the way forward with groundbreaking research

The UCLA ACHD center has been involved in groundbreaking research that is paving the way with new treatment options for adults living with congenital heart disease.

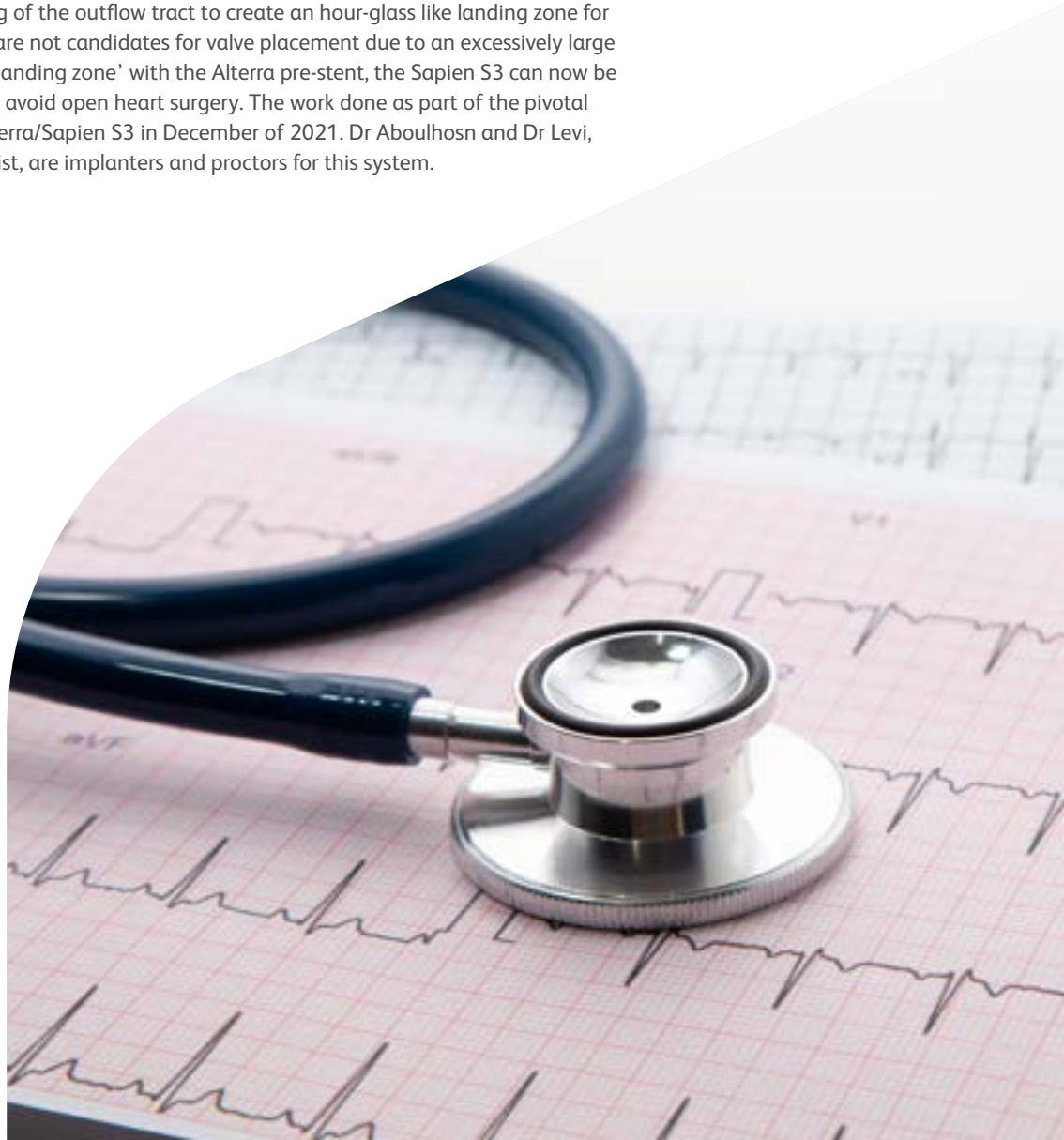
Compassion S3 trial

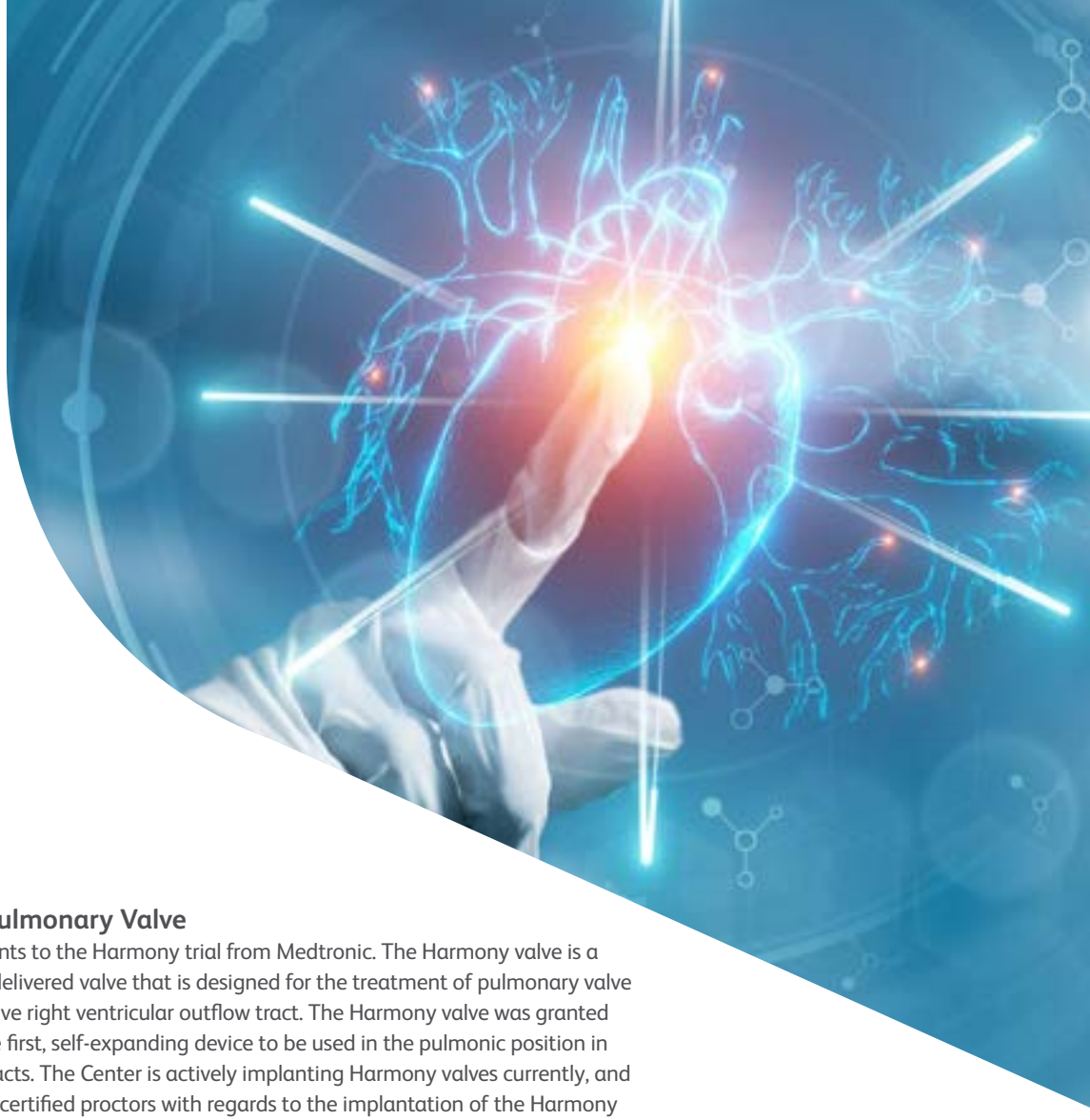
The Edwards Compassion S3 study is a multicenter study that examined the effectiveness of the Edwards SAPIEN S3 Transcatheter Heart Valve in patients with pulmonary regurgitation or right ventricular outflow tract conduit or valve obstruction. At three-year follow-up visits, the results have been overwhelmingly positive, demonstrating excellent valve function. In addition, there was an improvement in clinical outcomes such as improved overall cardiac function, and a decreased likelihood of patients needing to undergo open heart surgery.

The SAPIEN S3 Transcatheter Heart Valve was granted approval by the FDA in 2020. The UCLA ACHD team played an important role in this approval. It is a source of pride, that our center was one of the top enrolling sites in the entire study. Thus continuing the commitment to bringing the most innovative and best possible care to our patients.

Alterra Adaptive Pre-stent trial

The Alterra Adaptive Pre-stent is a self-expanding partially covered nitinol platform that is deployed within the native right ventricular outflow tract in patients with pulmonary valve regurgitation. This pre-stent allows for the remodeling of the outflow tract to create an hour-glass like landing zone for the Sapien S3 valve in those who are not candidates for valve placement due to an excessively large 'landing zone'. By reshaping the 'landing zone' with the Alterra pre-stent, the Sapien S3 can now be safely implanted and patients can avoid open heart surgery. The work done as part of the pivotal trial let to FDA approval of the Alterra/Sapien S3 in December of 2021. Dr Aboulhosn and Dr Levi, Interventional Pediatric Cardiologist, are implanters and proctors for this system.





Harmony Transcatheter Pulmonary Valve

The Center also contributed patients to the Harmony trial from Medtronic. The Harmony valve is a covered self-expanding catheter delivered valve that is designed for the treatment of pulmonary valve regurgitation in patients with native right ventricular outflow tract. The Harmony valve was granted FDA approval in early 2021 as the first, self-expanding device to be used in the pulmonic position in native right ventricular outflow tracts. The Center is actively implanting Harmony valves currently, and both Dr. Aboulhosn & Dr. Levi are certified proctors with regards to the implantation of the Harmony valve. The Center was also a contributor to the trial that led to FDA approval of this valve.

"We are in a new era where the majority of congenital pulmonary valve abnormalities can be treated with transcatheter techniques and we can avoid open heart surgery, said Dr. Aboulhosn. With our advanced imaging technologies we are able to accurately identify which patients may benefit from these advances and in the majority of cases can virtually perform valve implants on MRI and CT models before attempting to do so in the patient" he added.

For more information, please visit https://www.uclahealth.org/international-services/ or call +1 310-794-8759.

Recent developments in cardiology

AI in home-based cardiology

AI could help deliver a revolution in cardiology through ultrasound based in the home, according to ultrasound manufacturers.

In June 2022, the American company Caption Health, a leader in using AI and services to improve heart ultrasound access, launched its home-based heart ultrasound service 'Caption Care'. Caption Health may be ahead of the game, but all major ultrasound manufacturers are keenly watching how this area develops. Within the next five or 10 years, home-based ultrasound could become as common as home-based blood pressure monitors. The potential implications for public health could be enormous.

In this context, AI is a game changer. AI-based systems make it feasible, for the first time, to guide an untrained user to acquire high-quality ultrasound images. AI-based systems also make it possible to accurately and instantly compute the kinds of physiological measurements which can indicate disease.

Ultrasound is the hard case, compared to other types of medical imaging. X-ray, CT and MRI involve the acquisition of a standard image aligned with obvious anatomical features. But with ultrasound, imaging is done by sweeping the probe over the surface of the body, giving a flowing time series of impressions.

This is an area of medical AI that has potentially major implications for cardiology and public health in general, however.

The British Medical Ultrasound Society (BMUS) recently stated that 'ultrasound equipment should only be used by properly trained professionals and only when an ultrasound examination is needed, either for clearly defined clinical reasons or for the training of healthcare professionals.'
The BMUS has been keen to point out that ultrasound involves small but real risks and therefore exposure should be 'as low as reasonably achievable'.

Transcatheter aortic valve implantation (TAVI) market expands, implantation techniques and innovation necessary

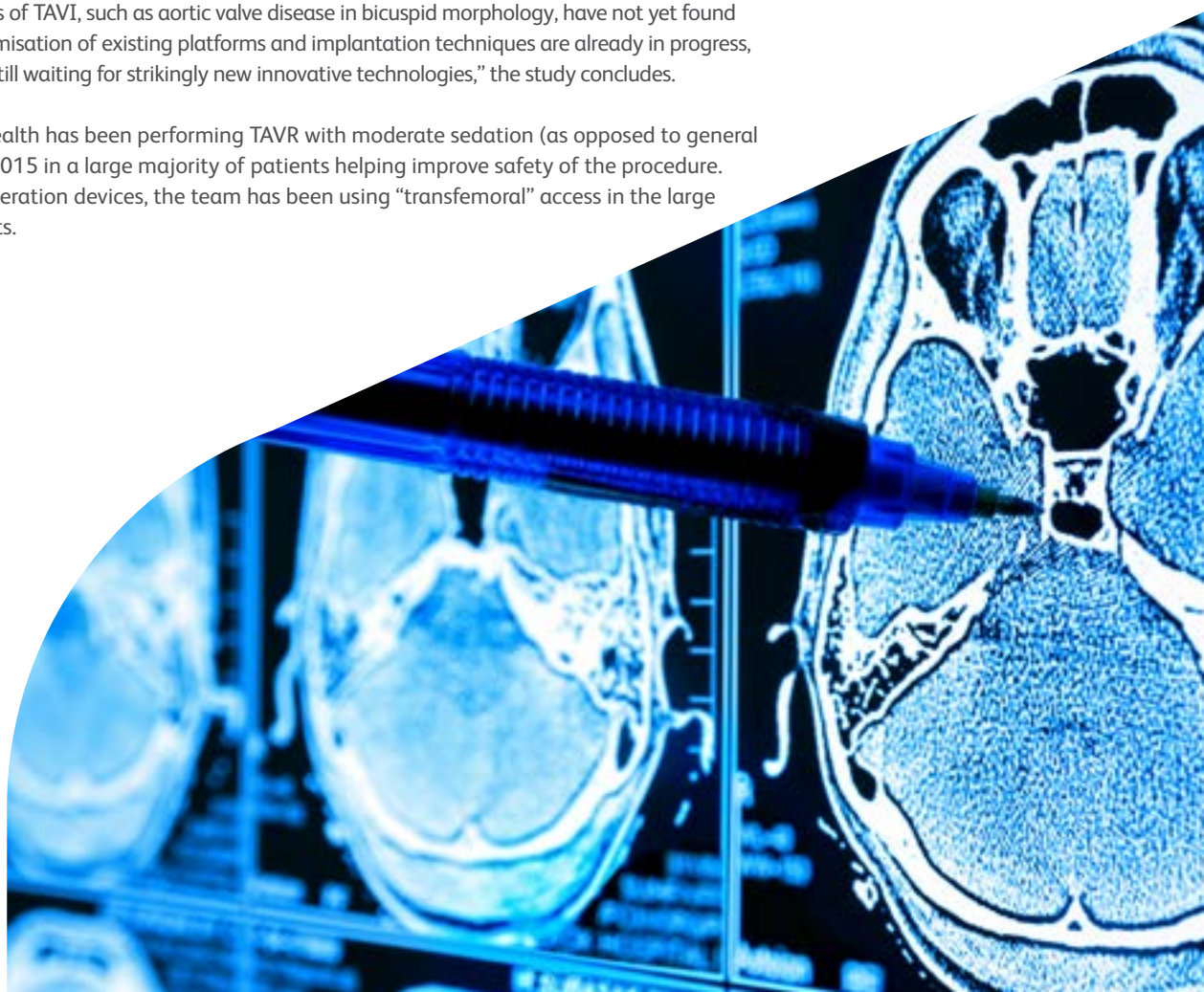
Transcatheter aortic valve implantation (TAVI) has transformed severe aortic stenosis (AS) patient treatment and has already been implanted in over 250,000 people in over 65 countries worldwide, according to a journal published in the *Spanish Society of Cardiology*. In 2015, approximately 70,000 patients were implanted, a number expected to quadruple to over 280,000 by 2025.

A June 2022 editorial published in *Expert Review of Cardiovascular Therapy* journal argues that though the market currently offers a wide choice of self-expanding (SE) devices, matching the best device to each patient is a main goal in order to compete with balloon-expanding (BE) ones.
TAVI represents a dynamic, constantly evolving field of interest for interventional cardiology. Despite few head-to-head comparisons and evidence coming from metanalysis and retrospective studies, BE TAVI devices have been always considered superior to SE ones thanks to quicker procedural times, lower incidence of acute kidney injury, lower rate of PPI and less significant PVL that all translate into shorter hospital stays and improved long-term outcomes.

Some issues related to the use of SE devices still need to be addressed and further implementation aims to parallel expanding indications to TAVI.

Some niche indications of TAVI, such as aortic valve disease in bicuspid morphology, have not yet found the ideal device. "Optimisation of existing platforms and implantation techniques are already in progress, but unmet needs are still waiting for strikingly new innovative technologies," the study concludes.

The team at UCLA Health has been performing TAVR with moderate sedation (as opposed to general anaesthaesia) since 2015 in a large majority of patients helping improve safety of the procedure. Using the newest generation devices, the team has been using "transfemoral" access in the large majority of its patients.



ECG can rule out the presence of HFrEF in type-2 diabetes patients

Type-2 diabetes (T2D) mellitus is the ninth major cause of death worldwide and the number of patients living with T2D is expected to increase dramatically in the coming decades.

Heart failure (HF) in patients with T2D is increasingly receiving attention due to recent cardiovascular trials. This was found to be the second most common initial manifestation of cardiovascular disease in T2D in a cohort of 1.9 million people.

In early studies of unselected patients from primary care with suspected chronic heart failure, the presence of a normal ECG was found useful to rule out heart failure with reduced ejection fraction (HFrEF). HFrEF is associated with morbidity and mortality, with 50 per cent of patients dying within 5 years of diagnosis.

A July study published in *Scandinavian Cardiovascular Journal*, conducted with 722 people, confirms that a standard ECG when normal in stable outpatients with T2D can be used to rule out HFrEF or asymptomatic left ventricular systolic dysfunction.

The study also suggests collaboration between cardiology and diabetologist, describing this as vital for patients, and if there is suspicion of heart failure with preserved ejection fraction (HfpEF) or heart failure with mid-range ejection fraction (HfmrEF), the patient should be referred for echocardiography.

CVD risk increased after three hours of sedentary activity

The relationship between TV viewing and cardiovascular disease (CVD) risk is curvilinear, according to an August 2022 article in *Expert Review of Cardiovascular Therapy*. The lowest risk can be observed for TV viewing time less than two hours daily and an increased risk beyond a threshold of three to four hours per day.

Binge TV viewing is a predominantly sedentary behaviour, the article explains, involving high levels of immobilisation or inactivity. This can drive the pathogenesis of venous and arterial thromboembolic disease.

Regular physical activity could play a major role in preventing the increased risk of venous thromboembolism (VTE) associated with binge watching.

According to Dr. Syed Sakib Nazir, Specialist Interventional Cardiologist at Fakeeh University Hospital, Dubai, physical inactivity – especially watching television for three to four hours – not only puts the patient at a higher risk of heart and stroke, “It also increases the incidence of blood clot formation in the veins of the leg known as deep vein thrombosis. The blood clot can break up and travel to the lungs, causing pulmonary embolism which may become a life-threatening condition.”

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