#1 in California and #3 in the Nation for Cardiology & Heart Surgery
#1 in California and
#3 in the nation for Cardiology & Heart Surgery in U.S. News & World Report's “Best Hospitals 2022-2023” rankings

#2 hospital in the nation and
#1 in California in U.S. News & World Report's “Best Hospitals 2022-23” rankings

#1 adult heart transplant program in the nation

#1 in the nation for expertise in transcatheter aortic valve replacements

Each year, thousands of people trust their hearts to the Smidt Heart Institute at Cedars-Sinai.

Our cardiologists, cardiac surgeons and specialized care teams treat the full spectrum of cardiovascular disease, while our investigators advance the field with groundbreaking, lifesaving research.

From genetic counseling and targeted drug therapies to an increasing array of minimally invasive procedures, Cedars-Sinai stands at the forefront of technology, innovation and discovery—all centered on improving patient outcomes.
In cardiology, cardiac surgery and vascular surgery, the Smidt Heart Institute at Cedars-Sinai continues to be one of the top-ranked heart programs in the United States.

Providing exceptional care for patients dealing with the most complex and challenging conditions is what drives us and pushes our science forward. Year after year, our outstanding multidisciplinary experts strive to reach new levels of excellence in clinical care, education and research.

The enclosed annual report highlights some of the ways in which we excel. We welcome your comments and questions and would appreciate the opportunity to help you with challenging patients you wish to refer to us. Please contact us at heartinstitute@cshs.org, or visit our website at Cedars-Sinai.org/heart for more information.

**MESSAGE FROM LEADERSHIP**

**Smidt Heart Institute**
Executive Director: Eduardo Marbán, MD, PhD
Mark Siegel Family Foundation Distinguished Chair in Cardiology and Biomedical Sciences

**Department of Cardiology**
Chair: Christine M. Albert, MD, MPH
Lee and Harold Kapelovitz Distinguished Chair in Cardiology
Professor of Cardiology
President, Heart Rhythm Society, 2020-2021

**Department of Cardiac Surgery**
Chair: Joanna Chikwe, MD
Irina and George Schaeffer Distinguished Chair in Cardiac Surgery in honor of Alfredo Trento, MD
Professor of Cardiac Surgery
Editor-in-Chief, The Annals of Thoracic Surgery

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**POINTS OF PRIDE**

- The No. 1 choice for complex **heart transplant** patients in the U.S. and around the world
- The leading program for state-of-the-art minimally invasive **lung transplantation**
- Performed more thoracic organ transplants than any other program in California in 2022

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<td>The most innovative <strong>mechanical circulatory support</strong> technology available</td>
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<td>More <strong>total artificial hearts</strong> implanted than any program in the U.S.</td>
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<td>The first robotic lung transplants ever performed</td>
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<td>&gt;1,500 robotic mitral valve repairs with near 100% success rates</td>
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<td>Top outcomes nationally for patients with <strong>coronary artery disease</strong></td>
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<td>Leading the integration of <strong>artificial intelligence</strong> into advanced cardiac care and imaging</td>
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The No. 1 choice for complex and high-risk structural heart disease cases in the U.S.

- >5,000 TAVR procedures performed to date
- >1,000 MitraClip procedures performed from 2017-2021
- >200 transcatheter tricuspid valve repairs and replacements
- 100% early survival with >20 years experience in the Ross procedure
- First-in-human novel percutaneous pulmonary valve replacement

- National leaders in **cardiac arrest** prevention and research
- A unique protocol for **atrial fibrillation** that reduces hospitalizations and emergency room visits

- Advanced diagnostics for **prevention**, early detection and treatment of heart disease
- One of the nation’s leading centers for drug-resistant and secondary **hypertension**

- A dedicated clinic for state-of-the-art assessments of **COVID-19** cardiac complications

- The first choice for maternity, pediatric and **congenital heart disease care**
- 100% survival in FY2021-2022 across the full spectrum of **pediatric cardiac surgery**

- National leaders in advanced percutaneous, surgical and hybrid **robotic coronary revascularization**

- Pioneers in the identification and treatment of **heart disease in women**, new diagnostic tools and advancing specialized care
No matter their heart condition, treatment history, complications or risk factors, every patient sent to the Smidt Heart Institute Advanced Heart Disease Program for evaluation or treatment can access an unrivaled range of clinical experience and technical expertise. When patients are coping with debilitating cardiomyopathy, they receive the benefit of an integrated, thoughtful team evaluation and a tailored treatment plan.

**From inpatients to research participants**
Cedars-Sinai’s dedicated 56-bed Advanced Heart Disease step-down unit provides round-the-clock inpatient monitoring for heart patients. Cardiac nurses offer improved oversight of specialty heart devices to enable rapid response and stabilization—resulting in better preparedness for transplant or discharge, as well as increased enrollment into clinical trials.

Research efforts such as our Cardiac Amyloidosis Registry Study—the only comprehensive U.S. registry of its kind—supplement our robust clinical program, which has few national counterparts. This endeavor, together with the numerous clinical trials we offer, has already made substantial inroads into developing novel treatments and improving quality of life for those with this devastating disease.
Patients with heart failure treated at Cedars-Sinai experience among the best outcomes in the nation, thanks to an integrated heart team that creates unique care plans for over 18,000 patients each year, state-of-the-art diagnostics and therapeutics, and seamless supportive care from hospital to home.

FROM RESEARCH TO THE WORLD

Cross-disciplinary and multi-institutional collaborations have catapulted participation in genetic research that will enable greater precision therapy for heart failure patients everywhere. These efforts support precision treatment plans that result in improved efficacy and reduced toxicity for complex patients—including those with chemotherapy-induced heart disease, hypertrophic cardiomyopathy and other challenging conditions.

Smidt Heart Institute clinicians and investigators routinely improve the standard of care for advanced heart disease patients through scientific publications, participation in professional society boards and guidelines, and continuing medical education offerings worldwide.

RELEVANT RECENT PUBLICATIONS

Cardiac Amyloidosis: Evolving Diagnosis and Management, *Circulation*, PMID: 32476490

Quantitative analysis of myocardial hypermetabolism and perfusion for diagnosing cardiac sarcoidosis, *Journal of American College of Cardiology*, PMID: 32462631

What have the latest research findings revealed about how best to diagnose and manage suspected cardiac amyloidosis?

Cardiac biopsy with advanced tissue-staining techniques and genetic testing can confirm an amyloidosis diagnosis and subtype. Such classification is crucial to rule out mimicking diseases. While biopsy is the gold standard, it can be avoided with new developments in imaging, such as echo strain imaging (speckle tracking) and nuclear studies specific to different types of amyloidosis. Collaboration with noncardiac specialists should complement a full evaluation by advanced heart disease subspecialists and early consultation of cardiac electrophysiologists for arrhythmias. These assessments can reveal the most appropriate clinical trials and emerging therapies.
Almost 1 in 3 heart failure patients have circulating antibodies against foreign tissue, making it difficult to find compatible donors and elevating the risk of rejection for heart transplant candidates. Our carefully developed desensitization protocol, coupled with numerous trials investigating novel pharmaceutical options, allows patients with even 100% circulating antibody presence to undergo a heart transplant with minimal risk of acute and chronic rejection.

This dramatic increased opportunity for transplant therapy is extended further by our deep experience in mechanical circulatory support and the recently FDA-approved heart-in-a-box for donor organ care, which has transformed our regional pool of donor hearts into a national one.

These strides in pre- and post-transplant care have supported excellent five-year patient survival. We use prognostic biomarkers to diagnose true rejection and inform treatment decisions, helping us reduce invasive heart biopsies by 67% and improve diagnostic accuracy and care for patients at the greatest risk for poor outcomes.
Largest heart transplant program in the U.S. since 2010

★ ~120 heart transplants per year
★ >92% 1-year survival rate for the past 5 years
★ 135 total artificial hearts implanted to date

**BRINGING MOLECULAR BIOLOGY TO TRANSPLANTATION**

The Smidt Heart Institute is one of only four centers in the world included in an initiative funded by the National Institutes of Health (NIH) to reveal the RNA transcripts and activated immune pathways at play in heart transplant patients using standard biopsies. This molecular and spatial biology endeavor aims to utilize NanoString technology to reveal which patients are at risk for antibody-mediated rejection or cellular reactivity, even decades in advance.

The main clinical goal: adjust medication regimens to customize immuno-suppression in the peri-transplant period. Although the program has just begun, myriad existing biobank samples and AI applications hold tremendous potential to accelerate this approach to a cellular and immune-based understanding of heart health and, in doing so, to achieve the goal of true precision medicine.

**RELEVANT RECENT PUBLICATIONS**

Contemporary Left Ventricular Assist Device Outcomes in an Aging Population: An STS INTERMACS Analysis, *Journal of the American College of Cardiology*; PMID 34446160

Solid Gold, or Liquid Gold?: Towards a New Diagnostic Standard for Heart Transplant Rejection, *Circulation*; PMID: 33750203

Sensitization in Heart Transplantation: Emerging Knowledge: A Scientific Statement From the American Heart Association, *Circulation*; PMID: 30776902
Lung transplantation at Cedars-Sinai—a multidisciplinary collaboration between the Smidt Heart Institute and the Comprehensive Transplant Center—is characterized by innovations that are changing the landscape of cardiothoracic surgery and care. We are the only U.S. center offering minimally invasive and robotic-assisted lung transplant to adults with end-stage lung disease and, in 2022, we performed more lung transplants than most programs nationally.

Over the past two years, we have transitioned from offering traditional lung transplantation to minimally invasive lung transplantation to, now, robotic-assisted capabilities. This long-awaited achievement is the start of a new era of cardiothoracic care. Prior to pioneering the world’s first robotically assisted lung transplant, surgeons in the Smidt Heart Institute also developed new, minimally invasive techniques that speed healing and shorten hospital stays.

These outstanding outcomes in a complex case mix could not have been achieved without deliberate innovation in surgical techniques and effective desensitization protocols for immunologically sensitized patients.
Among the most successful ECMO bridge-to-lung transplants for COVID-19

**COVID-19 REVEALS POWER OF ECMO**

The COVID-19 pandemic compelled us to use ECMO as a bridge to recovery or transplant for patients with severe lung disease. This experience allowed us to successfully transplant many patients who would previously have been ineligible.

The New England Journal of Medicine published our analysis of lung transplantation in COVID lung disease, which showed excellent short-term outcomes (including 95.6% survival at three months) nationally. This was the first research demonstrating the potential of lung transplantation as an effective treatment of acute respiratory distress syndrome and pulmonary fibrosis caused by COVID-19.

**CASE STUDY**

A 57-year-old man with pulmonary fibrosis became the first Southern Californian—and possibly the first in the U.S.—to receive a minimally invasive double lung transplant. Forgoing a sternotomy incision, the minimally invasive approach involved an incision between the ribs and did not require the assistance of a heart-lung machine. The patient was discharged from the hospital after just nine days.

Scan the QR code to read this patient’s story.

**RELEVANT RECENT PUBLICATIONS**


Extracorporeal life support as a bridge to lung transplantation: Where are we now? *Journal of Heart and Lung Transplantation*: PMID: 36089445
Unrivaled Experience in Robotic and Transcatheter Mitral and Tricuspid Repair

The Smidt Heart Institute is home to one of the world’s best valvular disease programs and performs more robotic and transcatheter valve repairs than almost any other program in the United States.

Advanced valve disease reduces length and quality of life. The treatment options for patients with severe mitral and tricuspid regurgitation have historically been limited to relatively ineffective medical management or traditional surgery. Cedars-Sinai was among the first programs in the U.S. to recognize the importance of minimally invasive valve therapy, pioneering robotic and transcatheter valve repair. Our deep expertise and track record of technical and clinical innovation enables us to successfully treat many more patients with the most challenging valvular heart disease.

Robotic mitral repair restores normal life expectancy and quality in patients with mitral prolapse and regurgitation. Upward of 95% of mitral valve operations at Cedars-Sinai are performed robotically with a >99% repair rate, complication rate of less than 0.5% and the national Society of Thoracic Surgeons top 3-star rating for patient outcomes. These outstanding outcomes are recognized by the distinction of an American Heart Association Mitral Valve Repair Reference Center Award.
A KEY EVALUATION OF TRANSCATHETER MITRAL VALVE SOLUTIONS

Transcatheter edge-to-edge repair (TEER) has become standard of care for selected very high risk patients with severe primary mitral regurgitation; however, whether this safe and minimally invasive approach matches surgical repair in lower risk patients is unknown.

To determine whether TEER is a good alternative to surgical repair in these lower risk patients, Cedars-Sinai is leading the pivotal National Heart, Lung, and Blood Institute-sponsored randomized clinical trial, the Percutaneous or surgical Repair In Mitral prolapse And Regurgitation in patients aged >65 Years (PRIMARY) trial (NCT 05051033). The trial will randomize 450 patients with primary MR who are candidates for both procedures to surgery or TEER for primary mitral regurgitation. The study will compare long-term safety and effectiveness of the two approaches over five to 10 years of follow-up. PRIMARY will provide pivotal information to inform evidence-based guidance on treatment selection for future patients.

RELEVANT RECENT PUBLICATIONS


Durable Robotic Mitral Repair of Degenerative Primary Regurgitation With Long-Term Follow-Up, The Annals of Thoracic Surgery. PMID: 34437853

Best in Class

✴ Highest national STS 3-star ratings for mitral surgery quality (2017-2021)
✴ One of only 22 American Heart Association Mitral Valve Repair Reference Centers in the United States
✴ >1,500 robotic mitral prolapse repairs with near 100% success rates
✴ 1,580 MitraClip procedures (2013-2022)
Cedars-Sinai offers highly individualized care leveraging the full spectrum of contemporary surgical and transcatheter aortic valve therapies. Advanced surgical expertise includes aortic valve repair, valve-sparing surgery and the Ross procedure for patients with long life expectancy who wish to avoid anticoagulants.

Patients at Cedars-Sinai benefit from one of the most experienced transcatheter aortic valve replacement (TAVR) teams in the nation, providing access to cutting-edge trials and innovative new devices. With over 5,000 TAVRs performed to date, Cedars-Sinai leads the nation in volume, with some of the best outcomes to match.

**Personalized care and a focus on lifelong surveillance**

This high-volume, low-complication environment does not come at the expense of personalized care, research or technique innovation. Instead, it enables our interventionists and surgeons to recognize unique cases and risk factors, lead studies to advance practice and knowledge, and identify and implement ways to improve technique.

Our team approach ensures that therapy is driven by a patient's risk profile, preferences, medical history and a thorough understanding of the heart's condition to maximize each individual's chance at long-term wellbeing.
CASE STUDY
A 7-year-old patient born with aortic stenosis undergoes the Ross procedure, replacing her malformed aortic valve with her own pulmonary valve, which was then replaced with a valve from a human donor. By waiting until the patient was older, the team was able to place an adult-sized pulmonary homograft, which, when it deteriorates, can be replaced through a minimally invasive approach, not a reoperation.
Scan the QR code to read this patient’s story.

NEW OPTIONS FOR HIGH-RISK AORTIC REGURGITATION
The JenaValve trial offers a percutaneous treatment option for extremely frail or elderly patients with severe aortic valve regurgitation. This TAVR procedure uses a stent with three eyelet clips to capture the native valve leaflets—designed specifically for the anatomy of aortic regurgitation. We are still actively recruiting participants and expect this extension of TAVR options to further improve the breadth and quality of care offered to these patients.

RELEVANT RECENT PUBLICATIONS
Cerebral Embolic Protection during Transcatheter Aortic-Valve Replacement, New England Journal of Medicine; PMID: 36121045

Association Between Transcatheter Aortic Valve Replacement for Bicuspid vs Tricuspid Aortic Stenosis and Mortality or Stroke Among Patients at Low Surgical Risk, Journal of the American Medical Association; 326:1034-1044

Aortic valve experts
★ More than 500 aortic valve repairs and valve-sparing root replacements with outstanding long-term durability
★ 100% early survival with >20 years’ experience in the Ross procedure
★ >650 TAVRs performed in 2022
★ 85 valve-in-valve TAVRs to date
★ Leaders in less invasive aortic surgery
Acute aortic dissection is a pathological catastrophe that is frequently fatal. Lifesaving emergency surgery is indicated in almost all cases, and it remains one of the highest-risk procedures.

The best results are achieved in centers that provide a specialized aortic service. Cedars-Sinai has developed such a service—the Cedars-Sinai Specialist Aortic Service (CSSAS). It goes beyond the expertise of the individual cardiac surgeons who provide the dedicated on-call rotation for aortic dissection. CSSAS comprises highly specialized anesthesiologists, perfusionists, intensivists, cardiologists and vascular surgeons.

Looking beyond emergency surgery
The Smidt Heart Institute service has the capacity to look beyond the immediate situation. Improved early and long-term outcomes for type A aortic dissection are proven with continued selective cerebral perfusion, aortic valve-sparing root replacement, and extension of the aortic repair distally into the arch with a frozen elephant trunk or other endovascular stent.

Prevention as a first defense against aortic dissection
Even better than waiting to diagnose an aortic dissection is preventing it. Patients who might be at risk of developing aortic dissection are assessed by a multidisciplinary team of cardiac and vascular surgeons, cardiologists and radiologists who use advanced imaging techniques in cross-sectional imaging—including volumetric analysis and compliance measurement—to predict an individual patient’s risk and advise the patient on the best time to undergo prophylactic surgery.
Relevant Recent Publications

Improving efficiency of the barbershop model of hypertension care for Black men with virtual visits, *Journal of the American Heart Association*; PMID: 34155907

Hypertension and excess risk for severe COVID-19 illness despite booster vaccination, *Hypertension*; PMID: 35862106

Durability of blood pressure reduction after ultrasound renal denervation: Three-year follow-up of the treatment arm of the randomised RADIANCE-HTN SOLO trial, *EuroIntervention*; PMID: 35913759

Read More:

Investigators from the Smidt Heart Institute found that women who conceived while adhering to an anti-inflammatory diet had a significantly lower risk of developing preeclampsia during pregnancy. Scan the QR code for more.

Renal denervation

This simple investigational cath-lab procedure disrupts the blood-pressure-raising sympathetic nervous system’s signals to the kidney, lowering blood pressure by an average of 10 mmHg in clinical trials. New research led by Cedars-Sinai indicates the effect lasts at least three years. The procedure, under FDA review, has the potential to reduce pill burden, improve blood pressure control and reduce cardiovascular disease risk in a substantial number of hypertensive patients.

Meeting Patients Wherever They Are

Reaching patients in new ways and new places—be it at a barbershop, in the obstetrician’s office, at home via wearable monitors or even at their children’s wellness checkups—is a common thread across our hypertension research program.

Since the establishment of the Cedars-Sinai Hypertension Center of Excellence a decade ago, our cardiologists have scaled up their patient-focused research efforts. Among these endeavors is the famous community-based and pharmacist-led barbershop intervention to reduce uncontrolled blood pressure in Black male patrons, which is now undergoing post-pandemic reinvigoration.

Perinatal hypertension research is also flourishing, with efforts underway to explore hypertension’s association with poor birth outcomes and long-term cardiovascular disease risk among affected mothers. This emphasis leverages the expertise in our specialized cardio-obstetrics program and will help shape the future of cardiovascular care for women.
Mortality after acute myocardial infarction varies widely in U.S. hospitals. Cedars-Sinai combines deep expertise in coronary intervention with an individualized approach to prevention that has delivered health outcomes that consistently outperform the rest of the nation.

A skilled approach improves long-term outcomes
When it comes to cardiac surgery, it matters where you seek treatment. Our cardiovascular surgery program is a leader in advancing surgical techniques that improve the lives of patients with severe coronary artery disease—with a focus on long-term outcomes for younger patients.

Multiarterial coronary revascularization is ideal for severe coronary artery disease patients who are younger than 65 and have otherwise healthy hearts because it’s the longest-lasting treatment currently available. The multiarterial procedure involves an arterial bypass of multiple arteries, not just one.

That method is also vastly underutilized in the U.S.—currently received by less than 10% of eligible patients. Part of the reason that many medical centers have been slow to adopt the multiarterial coronary revascularization method is it puts an intense technical demand on the surgeon and requires additional expertise from the rest of the surgery team—especially to perform it as safely as conventional bypass operations. Cedars-Sinai also offers robotic coronary bypass surgery for patients seeking minimally invasive surgical revascularization.
EMBRACING CARDIOMETABOLICS
In addition to its focus on lipids, weight loss, nutrition, genetics and cardiac rehabilitation, the Preventive Cardiology Clinic involves active collaboration among cardiologists, nephrologists and endocrinologists.

Together, these disciplines offer holistic attention to therapies, interventions and wellness plans that improve heart health simultaneously with adiposity, glucose tolerance, kidney health and numerous cardiac, endocrine and metabolic measures. This collaboration can also improve medication coordination and management through cohesive, synergistic treatment plans that account for all aspects of a patient’s cardiovascular health.

Coupled with the supportive behavior-based plans issued by our early-intervention specialists, integrated and big-picture preventive heart care that can be delivered is the newest frontier for the Cedars-Sinai network.

RELEVANT RECENT PUBLICATIONS
The role of the preventive cardiologist in addressing climate change, *American Journal of Preventative Cardiology*; PMID: 36090522

Deep learning coronary artery calcium scores from SPECT/CT attenuation maps improves prediction of major adverse cardiac events, *Journal of Nuclear Medicine*; PMID: 36207138

The optimal strategy for multivessel coronary revascularization, *European Heart Journal*; PMID: 34788415

Hypertension and coronary risk factors are pervasive, especially in certain populations. Disparity reduction can be achieved via proactive engagement in the form of tailored messaging, additional screening locations and targeted education campaigns according to ethnicity, language, sex and gender identity. These efforts enable early-intervention specialists to treat people before they need acute care. This in turn increases awareness, facilitates more diverse participation in research and alerts the community to the importance of more aggressive action to reduce the risk of coronary disease.
A Smidt Heart Institute study suggests middle-aged and older women are being diagnosed with Takotsubo syndrome more frequently—up to 10 times more often—than younger women or men of any age.

READ MORE:
A Smidt Heart Institute study suggests middle-aged and older women are being diagnosed with Takotsubo syndrome more frequently—up to 10 times more often—than younger women or men of any age. Scan the QR code for more.

A Leading Research Program and Preeminent Clinical Destination for Women

After decades of leading-edge research into sex-based differences in women’s heart disease and physiology, clinician-investigators at the Barbra Streisand Women’s Heart Center of the Smidt Heart Institute have fine-tuned their approach to diagnostics and care.

The center brings unique insight into overlooked or misunderstood symptoms by applying advanced cardiac imaging and biomarker analysis that illuminate subtleties in presentation and disease progression among female patients. This expertise improves screening and diagnostic accuracy, enabling sex-appropriate treatment plans.

This contextual expertise arises from a number of trailblazing studies, such as the U.S. Department of Defense-funded Women’s IschemiA TRial to Reduce Events In Non-ObstRuctive CAD (WARRIOR), which aims to identify whether point-of-care prescriptions are effective for reducing heart disease in women. As these clinical investigations bear fruit for clinical practice, our physicians actively apply the latest evidence to generate care guidelines that can help women everywhere.
A focus on cardio-obstetrics

A combination of improved survival into adulthood among women with adult congenital heart disease (ACHD) and older women becoming pregnant has culminated in an increased need for cardiac expertise prior to, during and immediately after pregnancy.

Our cardio-obstetrics program has a creative infrastructure to maximize high-value care for severe hypertension, peripartum cardiomyopathy or other high-risk conditions throughout pregnancy. Trained nurses manage chronic conditions and preventive care efforts, with specialist oversight in case of emergency or acute care needs. Close collaboration with maternal-fetal medicine experts and ACHD cardiologists (paired, as needed, with comprehensive follow-up in the postpartum heart clinic and the Barbra Streisand Women’s Heart Center) ensures pregnancy-related cardiac conditions no longer go unrecognized and undertreated.

SMALL VESSEL DYSFUNCTION

This silent disease, which can result in progression to heart failure with preserved ejection fraction, has long puzzled cardiologists and evaded traditional imaging. A new NIH grant allows our investigative cardiologists to use novel MRI techniques to test the hypothesis that oxygen deprivation to the heart caused by small vessel dysfunction eventually forces heart muscle cells to revert to fetal metabolism. This metabolic switch from burning fat cells to using glucose may result in difficulty clearing triglycerides, resulting in small vessel dysfunction and heart failure.

THE “FRAMINGHAM OF PREGNANCY” STUDY

Cedars-Sinai cardiologists provide investigative leadership and biorepository services for the prospective Nulliparous Pregnancy Outcomes Study: Monitoring Mothers-to-Be Heart Health Study (nuMoM2b-HHS). Funded by the National Heart, Lung, and Blood Institute and the National Institute of Child Health and Human Development, the study will follow a portion of its 10,038 original participants for decades. It has already revealed an association between a history of migraines and adverse pregnancy outcomes.

RELEVANT RECENT PUBLICATIONS

Ischemia and No Obstructive Coronary Artery Disease (INOCA): Developing Evidence-Based Therapies and Research Agenda for the Next Decade, Circulation; PMID: 28289007

Mortality Risk in Takotsubo Syndrome Versus Myocarditis, Journal of the American Heart Association; PMID: 35766264

Autologous CD34+ Stem Cell Therapy Increases Coronary Flow Reserve and Reduces Angina in Patients With Coronary Microvascular Dysfunction, Circulation: Cardiovascular Interventions; 15:e010802
CONGENITAL HEART DISEASE

Attentive Care
Across the Lifespan

The opening of the Guerin Family Congenital Heart Program in the Smidt Heart Institute 10 years ago resulted in one of the world’s very few entities offering the full spectrum of care for congenital heart disease patients, all in one place, with continuity in the medical and surgical teams from infancy to adulthood. We offer not only fetal diagnostic services, but also complex cardiac imaging, advanced catheter interventions and cutting-edge clinical research programs.

Our physicians have pioneered hybrid procedures that combine surgery and cardiac catheterization, reducing the need for complex and risky open-heart surgeries. As our young patients with congenital heart disease age, they benefit from a robust continuum of care with access to our adult congenital team and a broad range of services, from cardio-obstetrics expertise to a congenital cardiac intensive care unit that supports ECMO and ventricular-assist devices, advanced heart failure therapies, mechanical-assist devices and heart transplantation.

READ MORE:
Jacqueline Avalon was born with ventricular septal defect. She's now a nurse at Cedars-Sinai. Scan the QR code for a video about the care she received at the Guerin Family Congenital Heart Program in the Smidt Heart Institute.
A STENT FOR LIFE

With FDA approval of both the Cedars-Sinai-invented patent ductus arteriosus closure device and the Alterra expandable valve enabling reconfiguration of “native” right ventricular outflow tracts, the Smidt Heart Institute is now pioneering investigations into a “stent for life.” It’s an extraordinary tool for pediatric cardiologists: a stent small enough for safe use in babies but flexible enough to expand with growing vessels as children age into adulthood.

The Renata Minima stent, created from an expandable cobalt chromium mesh, maintains its strength throughout its full diameter range of 2.0 to 22.0 millimeters. A promising feasibility study has resulted in approval of a multicenter pivotal trial to evaluate the safety and efficacy of the stent for use in neonates, infants and young children with congenital vascular stenosis. If approved, this stent could prevent many growth-related reoperations for congenital heart disease patients around the world.

RELEVANT RECENT PUBLICATIONS

DKS reconstruction and LPA size. Annals of Thoracic Surgery; PMID: 36113562

Preliminary testing and evaluation of the Renata Minima stent, an infant stent capable of achieving adult dimensions, Catheter Cardiovascular Intervention; PMID: 33942962
The Smidt Heart Institute cares for a high volume of patients who present with some of the most complex heart rhythm disorders, referred from around the nation. This presents unique opportunities to innovate and advance care through meticulous research and enthusiastic collaboration across subspecialties.

**Hybrid approaches in the OR**

One recent example is our state-of-the-art hybrid operating rooms that enable our cardiac electrophysiologists and surgeons to jointly employ epicardial as well as endocardial ablation approaches to effectively treat complex, scar-related ventricular tachycardias. This technique is frequently used for patients with advanced heart failure and refractory arrhythmias during open-heart surgery for implantation of mechanical support devices. The combined treatments can also address certain cases of difficult-to-treat atrial fibrillation, with the added benefit of left-atrial appendage closure with a minimally invasive surgical approach.

For atrial fibrillation patients, we have also designed and implemented a comprehensive program that provides precision care across the spectrum of risk-factor modification, pharmacological therapy, medications and procedural approaches for both arrhythmia and stroke management, as well as a comprehensive follow-up clinic. At the bench, our translational scientists continue to innovate to discover and develop novel biological therapies for treatment of these complex arrhythmias.
NOVEL CLINICAL TOOLS FOR PREVENTION OF SUDDEN CARDIAC ARREST

In our Center for Cardiac Arrest Prevention, two decades of research performed among population cohorts totaling nearly 2 million people has culminated in development of a novel ventricular fibrillation risk algorithm (VFRisk) that outperforms left-ventricular ejection fraction in predicting sudden cardiac arrest using noninvasive, widely available clinical markers. This tool, together with emerging data on ethnicity-driven risk factors for sudden cardiac death, holds significant promise for improved prevention efforts. Once refined using artificial intelligence tools and validated in another cohort of 400,000 patients, VFRisk could stimulate the next generation of clinical trials testing implanted defibrillators.

In a separate, ongoing prospective study (PRE-DETERMINE), researchers have reported that polygenic risk scores comprising genetic variants related to coronary artery disease have the potential to augment current approaches for prediction and prevention of this devastating condition.

RELEVANT RECENT PUBLICATIONS

Prediction of sudden cardiac death manifesting with documented ventricular fibrillation or pulseless ventricular tachycardia, JACC: Clinical Electrophysiology; PMID: 3545059

Polygenic risk score predicts sudden death in patients with coronary disease and preserved systolic function, Journal of the American College of Cardiology; PMID: 36007985

Biological substrate modification suppresses ventricular arrhythmias in a porcine model of chronic ischaemic cardiomyopathy, European Heart Journal; PMID: 35262692
Specialty leadership goes beyond the clinical excellence and innovation outlined in this report. In 2021-2022, many of our faculty served as principal investigators on NIH-funded research; editors of top academic journals; lead investigators of pivotal clinical trials; leaders of consensus statements and scientific sessions; and authors of over 500 podium research presentations and peer-reviewed manuscripts. Here are some of our highest-impact citations from 2021-2022.

**Cardiac Surgery**

**HIGH-IMPACT PUBLICATIONS FROM THE DEPARTMENT OF CARDIAC SURGERY FACULTY**


*Responses to a Neutralizing Monoclonal Antibody for Hospitalized Patients With COVID-19 According to Baseline Antibody and Antigen Levels: A Randomized Controlled Trial.*  *Ann Intern Med.*  2022 Feb;175:234-243


**Cardiology**

**HIGH-IMPACT PUBLICATIONS FROM THE DEPARTMENT OF CARDIOLOGY FACULTY**


Association Between Transcatheter Aortic Valve Replacement for Bicuspid vs Tricuspid Aortic Stenosis and Mortality or Stroke Among Patients at Low Surgical Risk. *JAMA*. 2021 Sep;326(11):1034-1044.


Immune Checkpoint Inhibitors: Acute and Chronic Cardiovascular Complications. *Nat Rev Cardiol* 2022.


Sex Differences in Blood Pressure Associations With Cardiovascular Outcomes. *Circulation* 2021;143:761-3


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**Research Funding FY22**

- $161.7M in total federal funding
- $23.3 M in new NIH research grants awarded
METRICS: PATIENT CARE

All Smidt Heart Institute Procedures  FY22 | FY18–22

- Catheterizations: 12,709 | 63,367
- Electrophysiology Procedures: 2,083 | 10,016
- Cardiac Surgeries: 1,701 | 7,322
- Advanced Imaging: 15,787 | 72,526
- Noninvasive Diagnostics: 156,639 | 713,572
- TOTAL: 188,919 | 866,803

Outcomes

30-Day Risk Adjusted Mortality
July 2018-Dec 2019 & July 2020-June 2021

- Heart Failure
  - Cedars-Sinai: 6.2%
  - National: 11.3%

- Heart Attack
  - Cedars-Sinai: 10.5%
  - National: 12.4%

Rankings

- #1 in California for 5 consecutive years
- #3 in the nation

U.S. News & World Report’s Best Hospitals Cardiology & Heart Surgery
### Electrophysiology Procedures FY22

- **Total Procedures:** 2,083
- **Inpatient:** 396
- **Outpatient:** 1,687

<table>
<thead>
<tr>
<th>Procedure</th>
<th>FY18</th>
<th>FY19</th>
<th>FY20</th>
<th>FY21</th>
<th>FY22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>32,927</td>
<td>35,865</td>
<td>34,208</td>
<td>40,009</td>
<td>45,258</td>
</tr>
</tbody>
</table>

### Cardiac Surgeries FY22 | FY18–22

#### Heart and Lung Transplantation and Mechanical Circulatory Support

- **Heart Transplants** (single and multi-organ) 107 | 596
- **Lung Transplants** (single and multi-organ) 74 | 168
- **Ventricular Assist Devices and Total Artificial Hearts** 50 | 345
- **Extracorporeal Membrane Oxygenation** 119 | 435

#### Robotic Cardiac Surgery

- **Robotic Mitral Repair** 147 | 690
- **Robotic Coronary Revascularization** 34 | 156

#### Valvular Heart Surgery

- **Mitral Valve Reconstruction** (repair and replacements) 253 | 1,083
- **Aortic Valve Reconstruction** (repair, valve sparing and replacements) 216 | 1,087
- **TAVR** 686 | 3,107

#### Aorta, Coronary and other Cardiac Surgery

- **Thoracic Aortic Open and Endovascular Surgery** 149 | 732
- **Coronary Revascularization** 241 | 1,284
- **Other** (congenital, septal myectomy, pericardiectomy) 145 | 272
Research Funding FY19–22

- FY19: $36,722,750
- FY20: $37,905,494
- FY21: $39,729,490
- FY22: $44,487,383

Clinical Trials FY22

- Enrolling: 201
- Total: 366

Peer-Reviewed Articles FY19–FY22

- FY19: 388
- FY20: 425
- FY21: 467
- FY22: 527

Intellectual Property FY22

- U.S. Patent Applications Filed: 276
- U.S. Patents Issued: 73
- International Patent Applications Filed: 195
- International Patents Issued: 73
- Copyright Registrations: 12

Philanthropy

1,085 donors supported the Smidt Heart Institute in FY22
## Endowed Chairs

<table>
<thead>
<tr>
<th>Name</th>
<th>Title or Chair Name</th>
<th>Role and Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eduardo Marbán, MD, PhD</strong></td>
<td>Mark Siegel Family Foundation Distinguished Chair</td>
<td>Executive Director, Smidt Heart Institute</td>
</tr>
<tr>
<td><strong>Christine M. Albert, MD, MPH</strong></td>
<td>Lee and Harold Kapelovitz Distinguished Chair in Cardiology</td>
<td>Chair, Department of Cardiology</td>
</tr>
<tr>
<td><strong>Joanna Chikwe, MD</strong></td>
<td>Irina and George Schaeffer Distinguished Chair in Cardiac Surgery</td>
<td>Chair, Department of Cardiac Surgery</td>
</tr>
<tr>
<td><strong>C. Noel Bairey Merz, MD</strong></td>
<td>Irwin and Sheila Allen Chair in Women’s Heart Research</td>
<td>Director, Barbra Streisand Women’s Heart Center</td>
</tr>
<tr>
<td><strong>Bojan Cercek, MD, PhD</strong></td>
<td>Eleanore and Harold Foonberg Chair in Cardiac Intensive Care (in honor of Prediman K. Shah, MD, FACC, FACP, FCCP)</td>
<td>Director, Coronary Care Unit Co-Director, Atherosclerosis Research Center Professor of Cardiology</td>
</tr>
<tr>
<td><strong>Joshua Goldhaber, MD</strong></td>
<td>Dorothy and E. Phillip Lyon Chair in Laser Research</td>
<td>Associate Director, CICU Director, Cardiology Fellowship Training Director of the Division of Applied Cell Biology &amp; Physiology Professor of Cardiology</td>
</tr>
<tr>
<td><strong>Martha Gulati, MD</strong></td>
<td>Anita Dann Friedman Chair in Women’s Cardiovascular Medicine and Research</td>
<td>Director, Preventive Cardiology Associate Director, Preventive and Rehabilitative Cardiac Center Associate Director, Barbra Streisand Women’s Heart Center</td>
</tr>
<tr>
<td><strong>Prediman K. Shah, MD</strong></td>
<td>Shapell and Webb Family Chair in Clinical Cardiology</td>
<td>Medical Director, Clinic for Hypertrophic Cardiomyopathy and Aortopathies Professor of Cardiology</td>
</tr>
<tr>
<td><strong>Robert J. Siegel, MD</strong></td>
<td>S. Rexford Kennamer, MD Chair in Cardiac Ultrasound</td>
<td>Chair in Cardiac Surgery Director Emeritus, Cardiothoracic Surgery Professor of Cardiac Surgery</td>
</tr>
<tr>
<td><strong>Alfredo Trento, MD</strong></td>
<td>Estelle, Abe and Marjorie Sanders Chair in Cardiac Surgery</td>
<td>Director Emeritus, Cardiothoracic Surgery Professor of Cardiac Surgery</td>
</tr>
<tr>
<td><strong>Jennifer Van Eyk, PhD</strong></td>
<td>Erika J. Glazer Chair in Women’s Heart Health</td>
<td>Director, Advanced Clinical Biosystems Institute in the Department of Biomedical Sciences Director, Basic Science Research, Barbra Streisand Women’s Heart Center Professor, Medicine Professor, Biomedical Sciences</td>
</tr>
<tr>
<td><strong>Peng-Sheng Chen, MD</strong></td>
<td>Burns and Allen Chair in Cardiology Research</td>
<td>Professor of Cardiology</td>
</tr>
<tr>
<td><strong>Susan Cheng, MD, MPH, MMSc</strong></td>
<td>Erika J. Glazer Chair in Women’s Cardiovascular Health and Population Science</td>
<td>Director, Public Health Research Director, Cardiovascular Population Sciences, Barbra Streisand Women’s Heart Center Associate Professor of Cardiology</td>
</tr>
<tr>
<td><strong>Jon A. Kobashigawa, MD</strong></td>
<td>DSL/Thomas D. Gordon Chair in Heart Transplantation Medicine</td>
<td>Director, Heart Transplant Program Professor of Cardiology</td>
</tr>
<tr>
<td><strong>Raj Makkar, MD</strong></td>
<td>Stephen R. Corday, MD, Chair in Interventional Cardiology</td>
<td>Vice President, Cardiovascular Innovation and Intervention Executive Director, Cardiac Interventional Services</td>
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</tbody>
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Contact Us

If you have a patient you would like to refer to one of our programs, please contact us at 310-423-3300, or visit Cedars-Sinai.org/heart for more information.

Our physicians will work with you to understand the unique needs of your patient. With you, they will develop the best treatment plan and will be available for additional consultations and procedures, as needed.

Aortic Disease
310-423-3851
This interdisciplinary team detects and treats the full range of diseases that affect the aorta and provides access to groundbreaking surgical techniques and leading-edge clinical trials.

Atrial Fibrillation
424-315-4413
The Atrial Fibrillation Program offers the latest diagnostic and therapeutic approaches for patients experiencing episodes of atrial fibrillation (AFib), with a unique protocol that reduces hospitalizations and emergency room visits.

California Heart Center
310-248-8300
The center, affiliated with the Smidt Heart Institute, offers the full spectrum of cardiology care, including cardiac evaluation, heart failure management, interventional cardiology, nuclear cardiology, echocardiography and hypertension management.

Cardio-Oncology
310-423-2726
Cardiologists diagnose and treat heart disease in patients who are undergoing cancer treatment or who are cancer survivors.

Cardiogenetics
310-423-2726
The Cardiogenetics Program provides a multidisciplinary approach for the treatment of patients and families afflicted with familial cardiac conditions. Patients are evaluated by a cardiologist who specializes in these conditions, together with a cardiac genetic counselor, to help clarify the patient’s diagnosis, create a personalized management of care plan based on genetic test results and provide a risk assessment for other family members afflicted with these conditions.
Cardiovascular Surgery
310-423-3851
Our cardiac surgeons are national leaders in robotic, minimally invasive and complex cardiac surgery.

Congenital Heart Program
310-423-1153
The Guerin Family Congenital Heart Program offers state-of-the-art treatment for congenital heart patients from birth through their entire adult life.

Electrophysiology
310-248-6679
The Clinical Electrophysiology Program provides state-of-the-art technology for patients with abnormal heart rhythms (cardiac arrhythmias and atrial fibrillation).

General and Preventive Cardiology
310-423-2726
The General and Preventive Cardiology Program provides patients access to medical professionals nationally recognized for their skills in the detection, prevention and treatment of heart disease.

Heart Failure and Cardiomyopathy
310-423-2077
As the anchor of the Advanced Heart Disease Program at the Smidt Heart Institute, the specialized Heart Failure Program provides a comprehensive assessment and treatment plan for people with congestive heart failure and all types of heart muscle disease (cardiomyopathy).

Heart Transplant
310-423-5460
For the past several years, Cedars-Sinai has led the nation in the number of adult heart transplants completed. The program offers advanced options in cardiac support devices, surgical techniques and anti-rejection technologies.

Hypertension
310-423-2726
The Hypertension Program takes a multispecialty approach to the evaluation and management of patients with complex hypertension. The program has been identified by the American Society of Hypertension as a certified Hypertension Center of Excellence.

Interventional Cardiology
310-423-3977
The Interventional Cardiology Program uses innovative nonsurgical techniques for treating coronary and valvular heart disease.

Lipid Disorders
310-423-2726
Cardiologists provide a full range of diagnostics and treatments for patients with cholesterol and triglyceride disorders.

Mechanical Circulatory Support
310-423-7338
The program provides complete care for patients with heart failure. Mechanical devices that help the heart pump blood can save the lives of patients awaiting a transplant. For others, they are a permanent treatment.

Preventive and Rehabilitative Cardiac Center
310-423-9660
The center gives cardiology patients tools to improve their health and fitness. Services include monitored exercise programs, nutrition advice and stress management.

Regenerative Medicine
310-423-1231
The Regenerative Medicine Program is composed of a multidisciplinary team of physicians and allied health professionals who provide the largest worldwide experience in cardiac stem cell therapy, including more than 10 different cell types and methods of delivery.

Valvular Heart Disease
Interventional: 310-423-3977
Surgical: 310-423-3851
The valve team, comprising highly specialized interventional cardiologists and cardiac surgeons, is at the forefront of providing novel, minimally invasive procedures to repair and replace heart valves. We offer a full spectrum of innovative procedures, ranging from completely percutaneous approaches to minimally invasive and traditional open-heart surgery. Treatment plans are individually tailored to the patient’s condition to ensure the best possible outcome.

Vascular Surgery
310-423-5400
The Vascular Surgery Program provides expert diagnosis and management of all arterial and venous disorders and offers a full spectrum of advanced open, endovascular and hybrid procedures.

Women’s Heart Diseases
310-423-9680
The Barbra Streisand Women’s Heart Center plays a leading role in identifying female-pattern heart disease, developing diagnostic tools and advancing specialized care for women.

1-800-CEDARS-1
heartinstitute@cshs.org
Cedars-Sinai.org/heart
#1 in California and #3 in the nation
for Cardiology & Heart Surgery in the 2022-23
U.S. News & World Report “Best Hospitals” issue

#1 adult heart transplant program in the nation

#1 in the nation for expertise in transcatheter aortic valve replacements