



2022

Annual Report

UW Medicine

HEART INSTITUTE

Dear Colleague,

I am proud to share our annual report for 2022. As director of the UW Medicine Heart Institute, I wanted to share this update with you. There have been many changes at the UWMHI and this report helps to highlight a culmination of the work that puts complex care at the heart of who we are. It is only possible through a team culture of collaboration that today we function with unique clinical specialty care but still provide a comprehensive service for all patients.

The UW Medicine Heart Institute is committed to serving a region that extends far beyond just the Puget Sound area. We pride ourselves in taking exceptional care of the most complex patients and regularly evaluate patients who have been deemed too high risk for interventions or procedures elsewhere.

This report summarizes the scope and subspecialized expertise using real case studies of complex patients over the last year. Our approach for exceptional care includes multidisciplinary teamwork paired with innovation. Our scholarly excellence makes for better care and provides treatment options that may not yet be widely available elsewhere.

In 2023, as always, we are here for you and your patients. Feel free to reach out if we can help--and meanwhile, please enjoy this reflection on 2022.

All the best,

Robb MacLellan, MD

Director of the UW Heart Institute

Cardiology Division Head

Executive Vice-Chair, Department of Medicine

3 **Advanced Heart Failure**
Heart Transplant & Mechanical Circulatory Support Program

5 **Congenital Heart Disease**
Adult Congenital Heart Disease Program

7 **Complex Arrhythmia**
Multidisciplinary Ventricular Arrhythmia Program

9 **Mitral Valve Repair**
Mitral Valve Reference Center

11 **Complex Coronary Intervention**
Complex Coronary Program

13 **Bicuspid Aortic Valve**
Multidisciplinary Thoracic Aortic Program

15 **Structural Heart Intervention**
Structural Heart Program

16 **Metrics**

18 **Research & Publications**

21 **Directory**



Advanced Heart Failure

Heart Transplant & Mechanical Circulatory Support Program

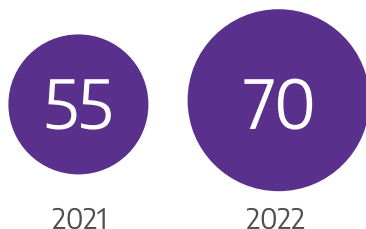
Donation After Cardiac Death (DCD) Heart Transplantation

DCD transplants are possible when a family — or patient, by advance directive — elects to withdraw life support when death is imminent. These donors allow traditionally ineligible donors to provide organs, so more patients' lives will be saved.

Case Study

A 48-year-old resident of Oregon was transferred from a partner hospital on **Extracorporeal Membrane Oxygenation (ECMO)** due to rapid decompensation. **Airlift Northwest**, a UW Medicine air transportation service, was activated and delivered the patient to UW Medical Center - Montlake. He then received an LVAD for circulatory support as a bridge to heart transplantation. A donor heart became available and **LifeCenter Northwest**, the Organ Procurement Organization for Washington, and UW Medicine's heart transplant team together facilitated the **Pacific Northwest's first donation-after-circulatory-death (DCD)** heart transplant. The heart donation was transported with the TransMedics **Organ Care System (OCS)**, a fully portable, multi-organ preservation device that allows us to measure markers of heart injury and function throughout the time that the heart is in the device.

Total Heart Transplants



#8 Heart Transplant Center in US

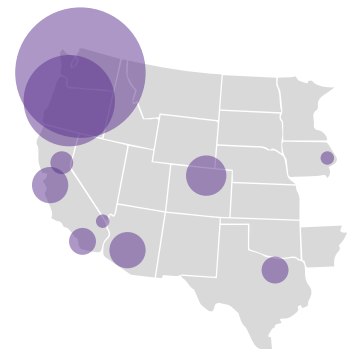
9 DCD transplants since Aug 2022

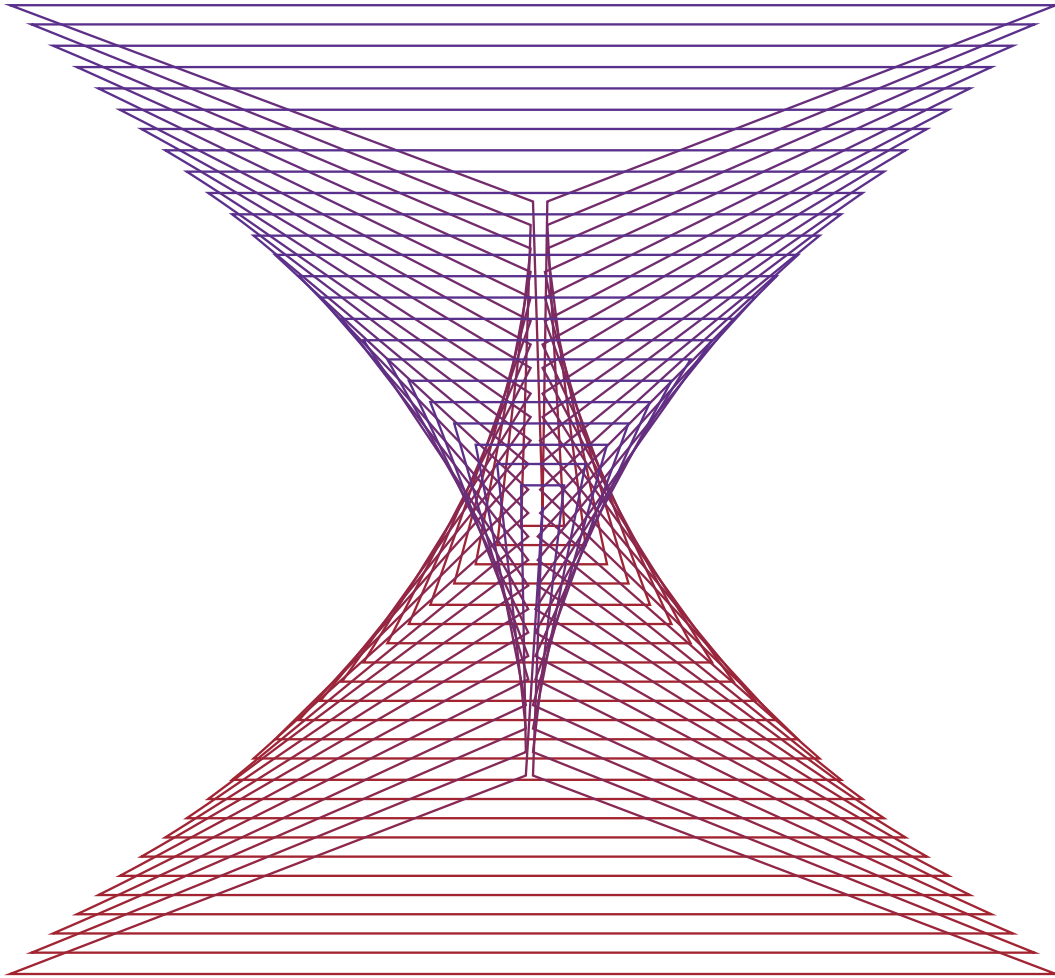
"Anything we can do to increase the number of potential donors will allow more patients access to this life-saving treatment."

Dr. Jay Pal, Surgical Director of MCS and Transplant

Research has shown that clinical outcomes of recipients of DCD hearts transported in the OCS device have positive outcomes similar to recipients of hearts from brain-dead donors. In May the U.S. Food & Drug Administration approved the use of the OCS device with hearts donated after circulatory death.

Donor Map 2022





Congenital Heart Disease

Adult Congenital Heart Disease Program

Congenital Heart Disease Pulmonary Valve Replacement

Our Adult Congenital Heart Disease (ACHD) program was one of the first accredited by the Adult Congenital Heart Association and is now one of the largest and busiest programs in the country. We are proud to have a strong partnership with colleagues at Seattle Children's Hospital to seamlessly transition adolescent patients into comprehensive adult congenital cardiology care.

Case Study

As a 12-year-old, a patient underwent open-heart surgery to repair her **congenital** pulmonary stenosis. At age 76 she was suffering from **severe pulmonary regurgitation**. She was enrolled in the clinical trial for the **"Harmony"** device and received the catheter-implanted valve indicated for her severe pulmonary regurgitation. The procedure was completed by Dr. Zach Steinberg of **UW Heart Institute** and Drs. Tom Jones and Brian Morray of **Seattle Children's Hospital**. She left the hospital after two days and was on the treadmill soon after.

"We are not abolishing the need for the original surgical repair for babies with congenital deficits, but for adult patients with severe pulmonary regurgitation, surgical valve replacement was the only option until now."

Dr. Zach Steinberg,
ACHD Interventional
Cardiologist

"We believe very strongly that congenital heart disease care should be performed by people whose job it is to care for congenital heart disease patients. It has taken a lot of work and collaboration to build our successful system that allows that to happen at both the adult and children hospitals."

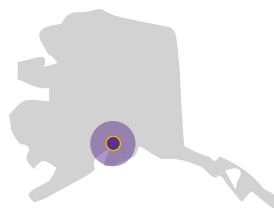
Dr. Eric Krieger,
Director of ACHD Program

2022 ACHD Highlights

2808 Patient Visits

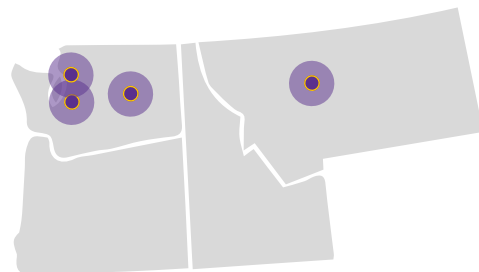
660 External ACHD Patient Referrals

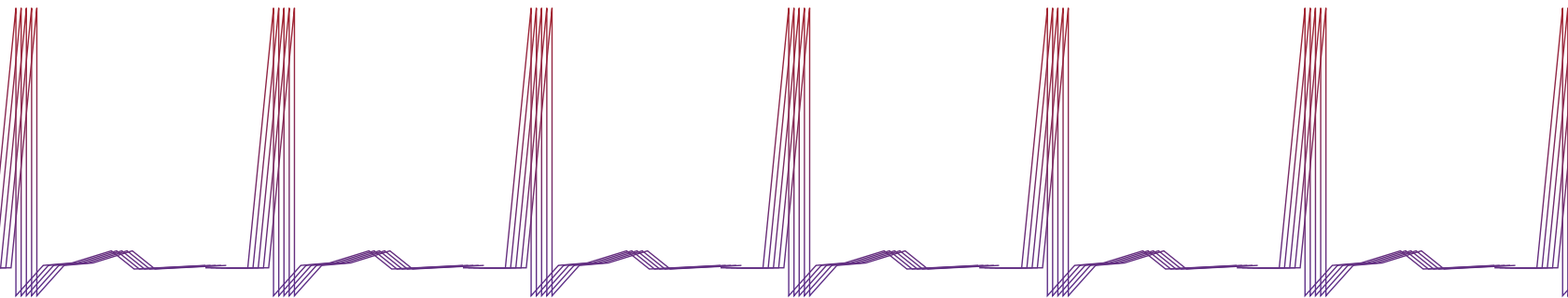
15 Members of the Multidisciplinary
Provider Team



Seattle, WA
Wenatchee, WA
Mountlake Terrace, WA
Great Falls, MT
Anchorage, AK

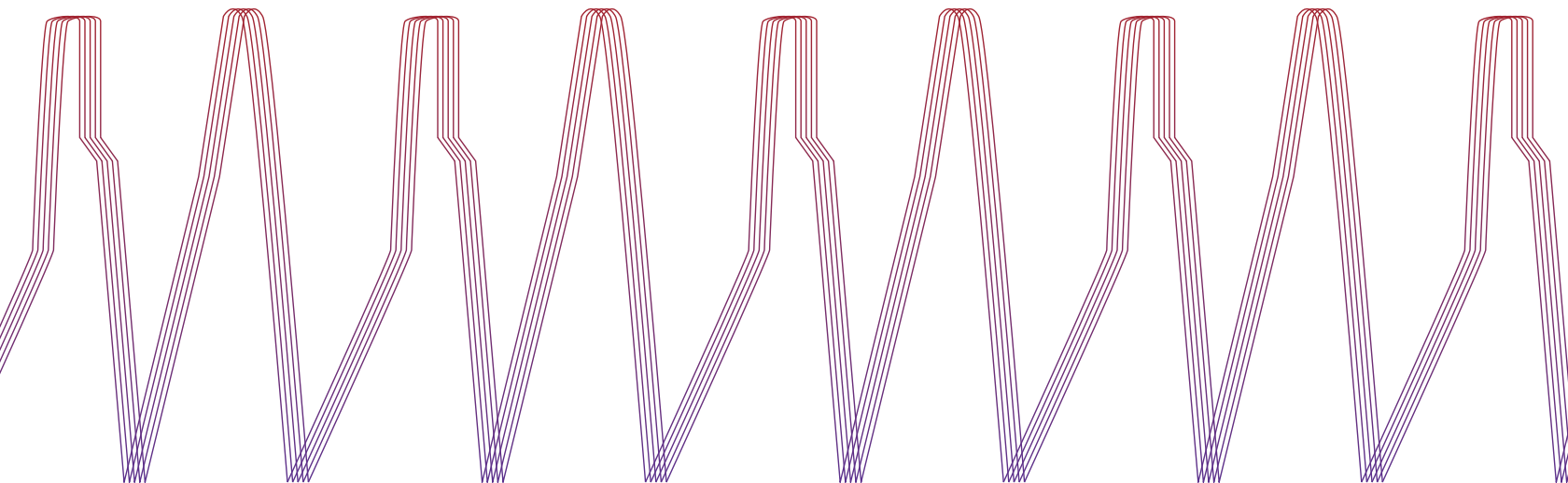
UW Heart Institute ACHD Clinic Locations





Electrophysiology

Multidisciplinary Ventricular Arrhythmia Program



Ventricular Tachycardia Ablation

The Multidisciplinary Ventricular Arrhythmia Program led by Dr. Babak Nazer provides comprehensive care for patients who have life-threatening arrhythmias and often receive painful shocks from their implantable defibrillators.

Case Study

A 55-year-old man with a history of **non-ischemic cardiomyopathy** who had undergone two prior endocardial ablations for **ventricular tachycardia (VT)** was referred to our **Multi-Disciplinary Ventricular Arrhythmia Program**. After consultation with Dr. Nazer and our **Cardiac Genetics** colleagues, he underwent genetic testing and was diagnosed with a rare genetic heart condition known to cause both cardiomyopathy and VT. He subsequently underwent **endocardial** and **epicardial VT ablation**, but more importantly, the underlying diagnosis allowed for us to refer the patient more urgently for consideration for heart transplant and to refer his first-degree relatives for cascade genetic testing to see if they are at risk for the same condition.

2022 Highlights

97 VT Ablations

68 PVC Ablations

“Our goal is to go beyond simply performing high-risk, complex cardiac arrhythmia ablation procedures. We work with our clinical partners to make underlying cardiac diagnoses for our arrhythmia patients, and to provide a broader panel of therapies ranging all the way from surgical procedures to psychological counseling.”

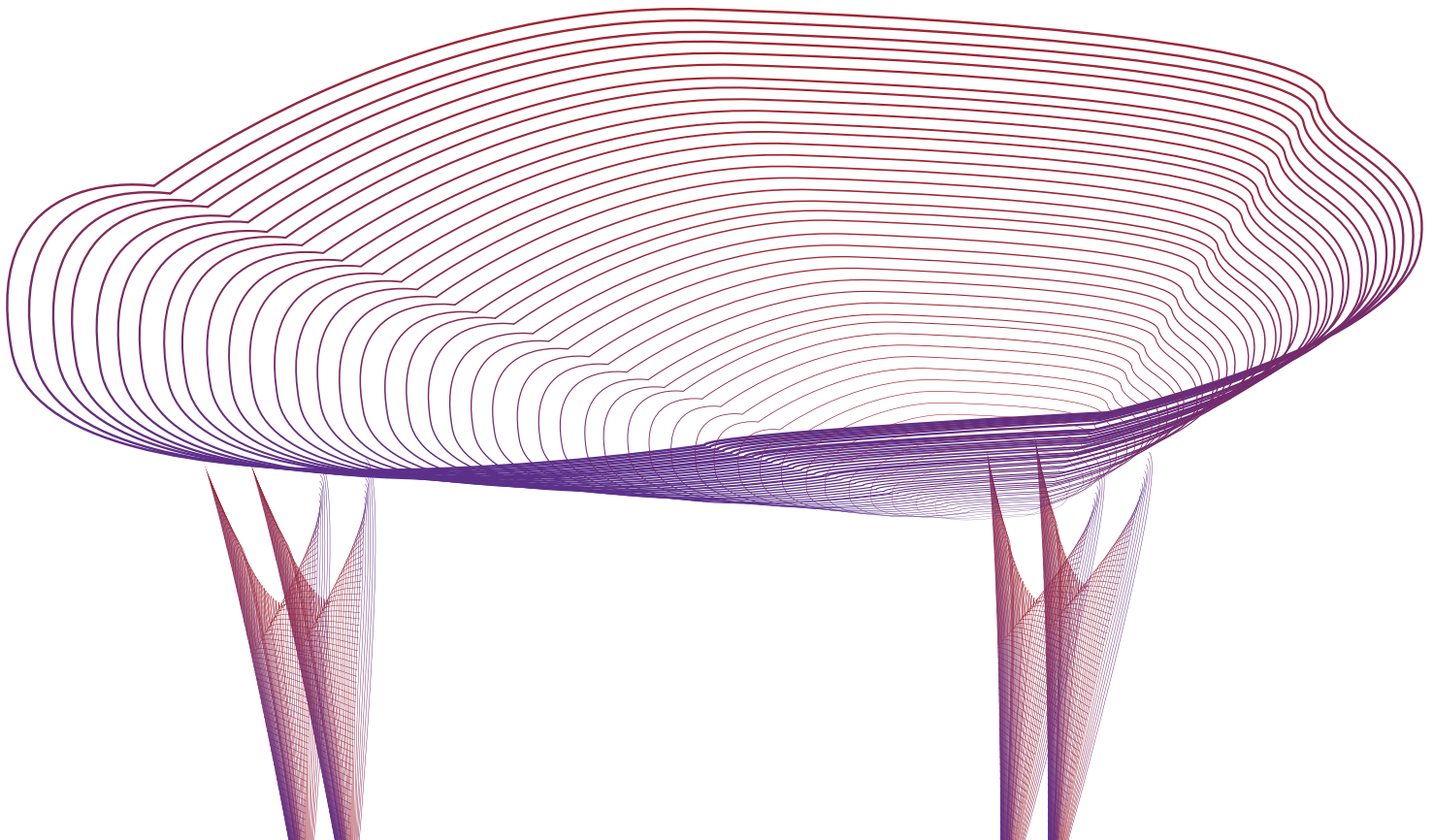
Dr. Babak Nazer,
Director of multi-disciplinary ventricular arrhythmia program

Dr. Nazer’s research laboratory designs, fabricates and validates the next generation of ablation tools to more effectively perform cardiac ablation using ultrasound energy both for ventricular arrhythmias as well as certain forms of genetic and structural heart disease such as hypertrophic cardiomyopathy.

Nazer B, Giraud D, Zhao Y, Hodovan J, Masri A, Gerstenfeld EP, Lindner J., High-Intensity Ultrasound Catheter Ablation Achieves Deep, Mid-Myocardial Lesions In-Vivo. Heart Rhythm, 2021 Apr;18(4):623-631

Cardiac Surgery

Mitral Valve Referral Center



Mitral Valve Repair

Many patients with severe mitral regurgitation and minimal symptoms are often diagnosed late or not offered earlier valve repairs, which significantly impacts their long term outcome.

Case Study

A 71-year-old man presented with **cardiogenic shock, hypertrophic cardiomyopathy and severe mitral regurgitation**. UW Medicine’s cardiogenic shock team was activated after request for transfer was initiated by an outside hospital due to lack of appropriate resources at the referring location.

The patient underwent an emergency **myomectomy and radical mitral valve repair** by Dr. Gabriel Aldea, Dr. Jay Pal and Dr. Lara Oyetunji. The collective effort by the UW Heart Institute cardiac surgery team, including the intensive care unit **VV ECMO** by Dr. Pal, ensured a full recovery for the patient.

Highlights

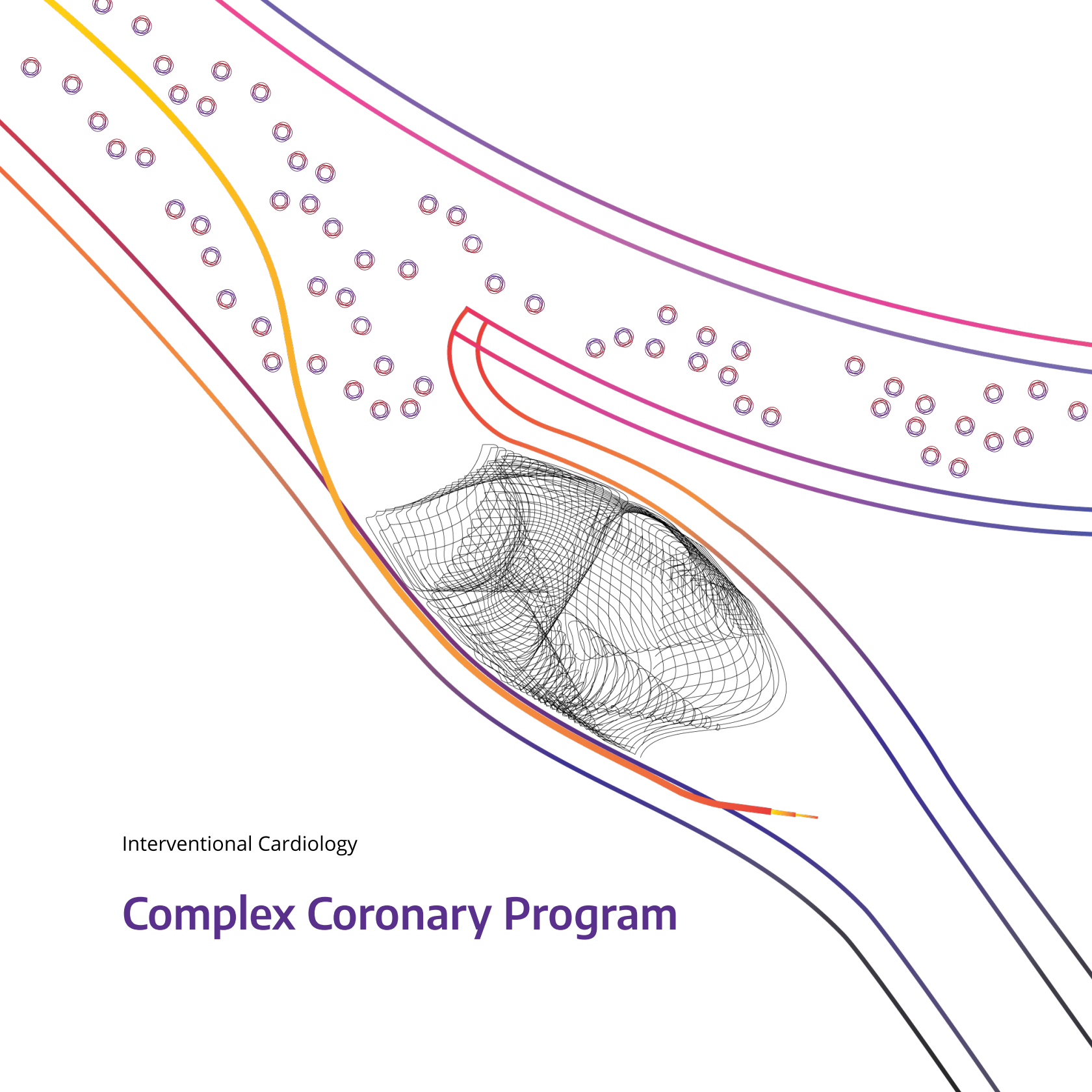
- 0% UW Medicine peri-operative mortality for the last 10 years for mitral valve repair
- 66% of patients had additional concomitant procedures in addition to mitral valve repair
- 80% of repairs were performed with complex pathologies
- 98% repair rates for the last 2 years with less than mild residual mitral regurgitation in post op/ follow up diagnostics

“UW Medicine Cardiac Surgery has a long history and tradition of leading care and innovations in cardiac surgery and in leading the PNW region by offering the highest specialized and individualized care offered in a multi-disciplinary patient-centered setting for the broadest aspect of cardiovascular conditions.”

Dr. Gabriel S. Aldea, William Edmark Professor, Chief of Cardiac Surgery

Over 2/3 of our mitral valve repairs are referred from outside of the system with complex pathologies and would have otherwise gotten valve replacements, with worse long term survival and functionality.

In 2022 the **American Heart Association & Mitral Foundation** awarded UW Medicine Heart Institute the **Mitral Valve Repair Reference Center** designation for demonstrating a record of superior clinical outcomes, as well as an ongoing commitment to reporting and measuring quality and outcome metrics specific to mitral valve repairs.



Interventional Cardiology

Complex Coronary Program

Chronic Total Occlusion PCI

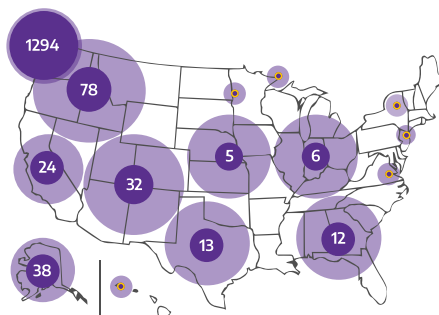
Chronic Total Occlusion Percutaneous Coronary Intervention (CTO PCI) allows an alternative to open heart surgery for coronary revascularization. It requires a proceduralist to become proficient in complication management. In addition to work on new techniques such as STAR to improve success rates with the aim of lowering significant complications, we have access to cutting-edge technology. One such example is a new balloon designed to treat bleeding complications (effectively applying pressure on the problem area) without compromising blood flow to the heart.

Case Study

63-year-old patient presented with chest pain symptoms so severe he was unable to do simple activities around the house. He found the **UW Heart Institute Complex Coronary** program and CTO PCI related content online. The patient agreed to participate as part of a **CTO PCI Event** at our Montlake campus, gathering experts in the field from all over the country. The procedure was completed safely and successfully and his symptoms demonstrably improved by the following day.

Highlights

17 Live Cast CTO
PCI Proctoring/
Events in 2022



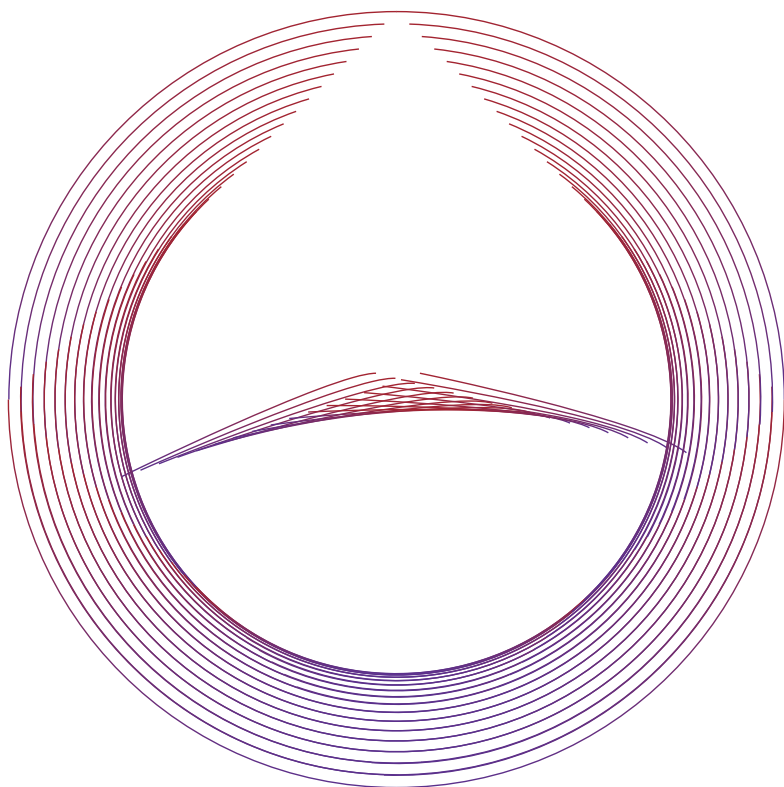
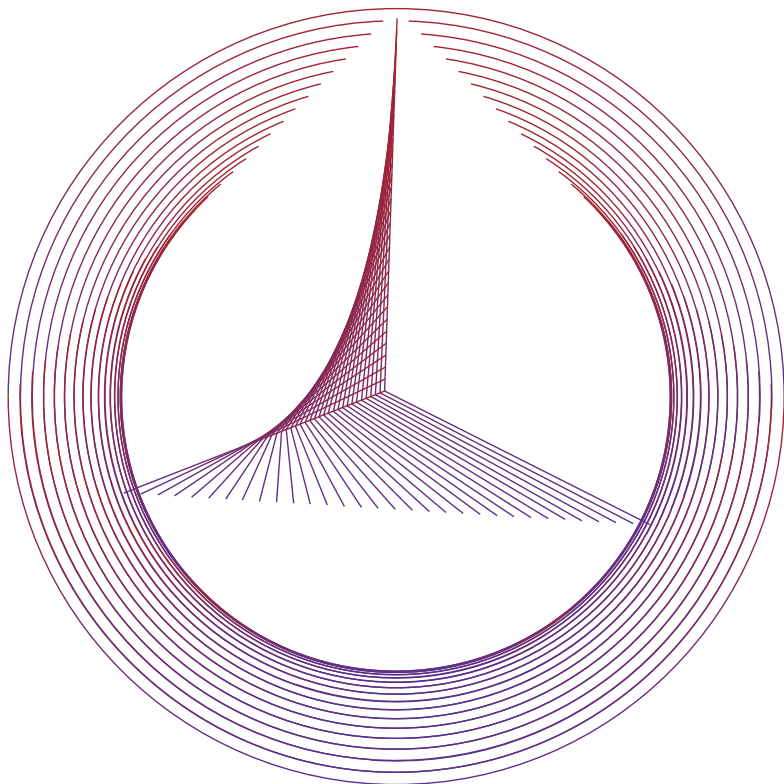
Complex Coronary Referrals 2020-2022

“We invest a lot into case proctoring and live case events on CTO PCI. As I transition to more of a mentorship role, I hope to give away as much of that knowledge, teaching people who want to learn. I hope to help other proceduralists understand the why of my decision making, why I choose the equipment or technical things I do to try and help them get to a higher skillset earlier than me, so they can take it to a higher level”.

Dr. Bill Lombardi,
Medical Director of
Complex Coronary
Program

“Advanced training in CTO and high-risk PCI gave me the freedom to have a shared decision-making conversation with patients about options for intervention based on their situation and not the angiogram.”

Dr. Kate Kearney,
Complex Coronary
Program Interventionalist



Cardiac Surgery

Multidisciplinary Thoracic Aortic Program

Ross Procedure

The Ross Procedure is a pulmonary autograft replacing the aortic valve and a pulmonary homograft/allograft to replace the pulmonary valve. Traditional mechanical valves are not ideal for some younger patients who may benefit from the longevity of an autograph and not having to take lifelong anticoagulant medications.

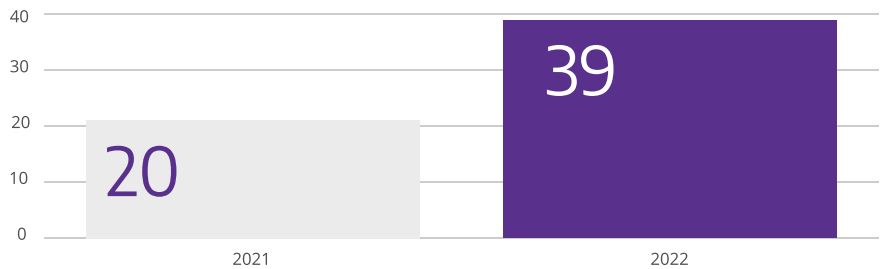
Case Study

A **37-year-old female** was admitted with critical aortic stenosis after having a syncopal event while exercising. She was diagnosed with a bicuspid aortic valve approximately three (3) months earlier. After extensive counseling, she wished to avoid anticoagulation given her desire to become pregnant.

She ultimately chose a **Ross procedure**, which was completed the following week. She was found to have a heavily calcified bicuspid aortic valve. She had a successful Ross procedure performed by the **Multidisciplinary Thoracic Aortic Program (MTAP) co-director Dr. Chris Burke** with an excellent result. Hospital discharge occurred 5 days later and she continues to do well.

Highlight

Program Growth of Ross Procedure



“Our Ross program continues to show strong growth as more and more patients seek out this innovative option for aortic valve disease. We are now a top 3 adult Ross program nationally. We have a dedicated multi-disciplinary team that helps navigate our patients through every facet of their care.”

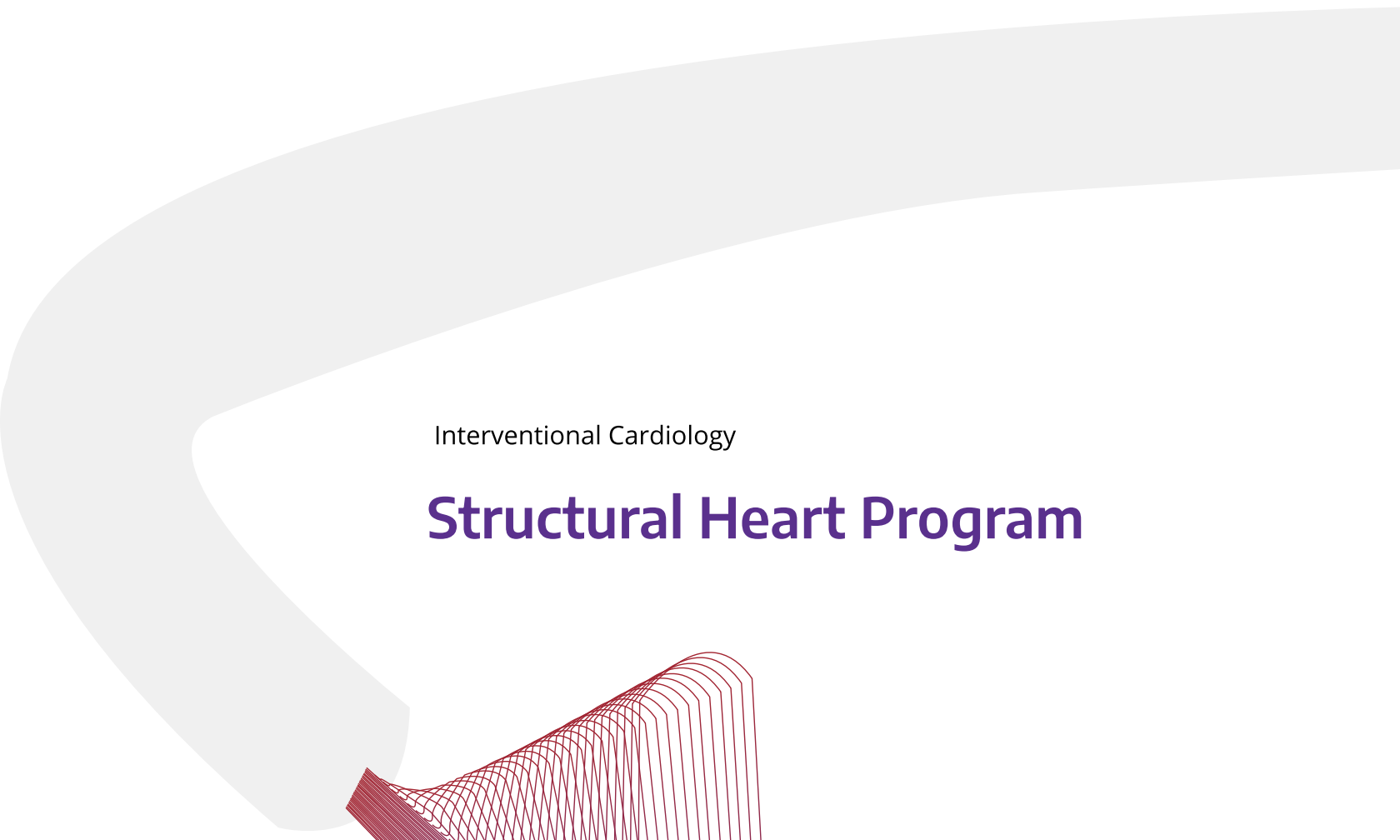
Dr. Chris Burke, Cardiac Surgeon & Co-director of MTAP Program

“The Ross procedure fits me, it fits my lifestyle. I don’t have to be reliant on blood thinners. I’m really excited to watch my daughter grow up, go camping with my family, and excited to enjoy life and not have to have that worry in the back of my head I had for so many years.”

Andy Dial, 34 yo, Recipient of Ross Procedure

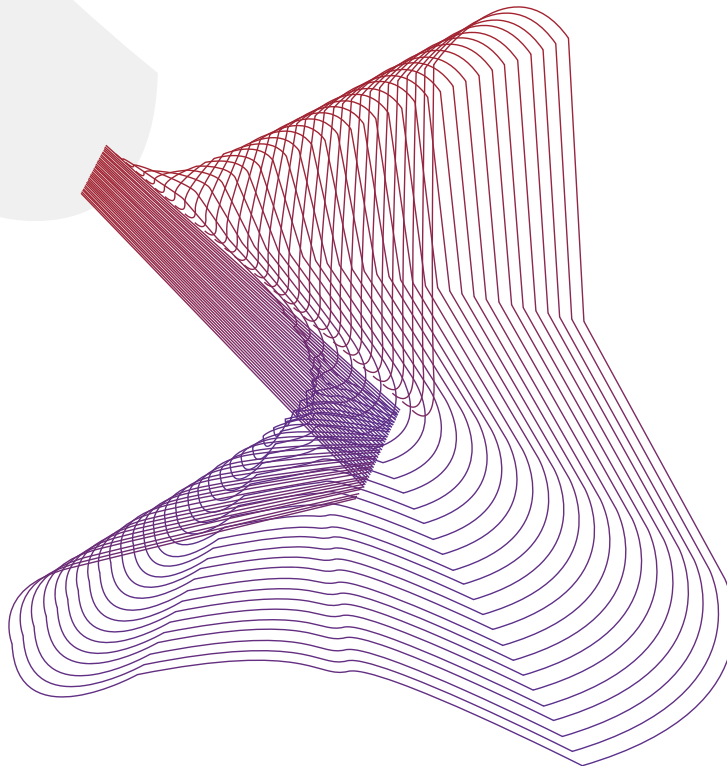


Multidisciplinary Thoracic Aortic Program (MTAP)



Interventional Cardiology

Structural Heart Program



Mitral Valve-in-Valve-In-Valve & Tricuspid Clip

Our structural heart program includes more expertise than any other team in the Pacific Northwest. Our team includes national leaders in valvular heart disease and transcatheter valve repair and replacement options.

Case Study

A 69-year-old woman from out of state with **complex valvular heart history** including a prior surgical mitral valve replacement followed by a transcatheter mitral valve-in-valve implantation. She developed new progressive fatigue and severe dyspnea on exertion. She was found to have **torrential tricuspid valve regurgitation** and **failure of her prosthetic mitral valve** and told there were no other options.

Following multidisciplinary evaluation by the UW Medicine Structural Heart team, her **tricuspid** regurgitation was successfully treated with **transcatheter edge-to-edge repair ('mitraclip')** by Dr. Jamie McCabe. But before returning home, Dr. McCabe and Dr. Gabriel Aldea were also able to perform a **valve-in-valve-in-valve transcatheter mitral valve replacement** after fracturing and enlarging the existing valves. The combined procedures completely restored her quality of life.

2022 Milestones

457 TAVR's

137 Edge-to-Edge "Mitraclip" Repairs

Top 5% of USA Programs

Top 2 implanter in USA

"The structural heart program continues to be one of the most rapidly evolving spaces in Cardiovascular care. New devices, new techniques and new care pathways seem to spring to life every month making transcatheter and minimally invasive valve replacement and repair options increasingly accessible across the spectrum of valvular pathology to patients previously considered too sick for any therapy or too healthy for catheter-based therapies."

Dr. Jamie McCabe,
Director of Cardiac Cath Lab
Section Chief of Interventional
Cardiology

Ongoing Clinical Trials

EVOQUE

Transcatheter Tricuspid Valve
Replacement

ENCIRCLE & APOLLO

Transcatheter Mitral Valve
Replacement

ALIGN

TAVR for Aortic Regurgitation



Cardiac Interventions

Total Cath & EP Lab Interventions **7,102**

Percutaneous Intervention (PCI) **1,083**
 Percent of PCI w/ Intravascular Ultrasound >86%
 Chronic total Occusions (CTO PCI) 411
 Brachytherapy 112

Structural Heart Intervention **961**
 Transcatheter Valve Replacements 457
 Aortic (TAVR) 401
 Mitral (TMVR) 31
 Tricuspid (TTVR) 4
 Pulmonary (TPVR) 21
 Edge-to-Edge (MitraClip) 137
 Tricuspid Valve (Repair & Replacement) 52
 Congenital Heart Related Interventions 120
 Atrial Septal Defect (ASD) 52
 Patent Foramen Ovale (PFO) 73
 Balloon Pulmonary Angioplasty 44
 Myectomy - Sesame 11

Electrophysiology Intervention **914**
 Atrial Fibrillation Ablation 317
 Ventricular Tachycardia (VT) Ablation 97
 Supraventricular tachycardia (SVT) Ablation 117
 Premature Ventricular Contraction (PVC) Ablation 68
 Cardiac Electronic Implantable Device (CIED) Implants 477
 Leadless Pacemaker Implants 13

660
 Edge-to-Edge
 (MitraClip)
 Repairs from
 2017-2022

350+
 Number of
 CTO-PCI
 performed per
 year 2017-2022

Cardiac Surgery

Operation Highlights

CY 2022

Heart Transplants	70
Ventricular Assist Devices and Total Artificial Hearts	38
Extracorporeal Membrane Oxygenation	42
Mitral Valve Repair	61
Coronary Revascularization (stand-alone and hybrid)	128
Mitral Valve Reconstruction (repair and replacements)	95
Aortic Valve Reconstruction (repair, valve sparing and replacements)	165
Ross Procedure	39

1160

Total Transplants
*through program's history



545

2022 Inpatient
Transfers Accepted
from Regional Hospitals

Heart Institute Clinic Volume

CY 2022

Total Visits	75,661
New Visits	12,875
Return Visits	42,560

Advanced Imaging

CY 2022

Transthoracic Echocardiogram	30,104
Transesophageal Echocardiogram	2180
Cardiac Nuclear Imaging	738

Research

Number of Awards

Public Health Service (PHS) Awards	24
Public Health Service-FT	6
Non-PHS/PHS-FT	29
Grant Proposals Requested	19

Number of

Investigators	30
Various Sponsors	25

Sum of Awards



Clinical Trials

Active	18
Recruiting	6
Pending Activation	6
Other	7

Additional Research

Preclinical	1
Clinical	6
Population Science	2
Quality Improvement	1

Noteworthy Publications

“Effect of dulaglutide on cardiovascular and heart failure outcomes in patients with and without heart failure”

Branch KR, Dagenais GR, Avezum A, Basile J, Conget I, Cushman WC, Jansky P, Lakshmanan M, Lanas F, Leiter LA, Pais P, Pogossova N, Raubenheimer PJ, Ryden L, Shaw JE, Sheu WH, Temelkova-Kurktschiev T, Bethel MA, Gerstein HC, Chinthanie R, **Probstfield JL**.

“Multichamber Strain Predicts Atrial Fibrillation in Cardiac Amyloidosis”

Yogeswaran V, Singulane CC, Slivnick JA, **Kirkpatrick JN**, Addetia K, Lang RM, Vasbinder A, Liu JE, Maurer MS, Cheng RK

“Explainable Machine Learning Analysis of Right Heart Failure After Left Ventricular Assist Device Implantation”

Bahl A, Qureshi BG, Zhang K, **Bravo CA**, **Mahr C**, **Li S**.

“Peri-procedural code status for transcatheter aortic valve replacement: Absence of program policies and standard practices”

Bernacki GM, Starks H, Krishnaswami A, **Steiner JM**, Allen MB, Batchelor WB, **Yang E**, Wyman J, **Kirkpatrick JN**.

“Effects of elevated systolic blood pressure on ischemic heart disease: a Burden of Proof study”

Razo C, Welgan CA, Johnson CO, McLaughlin SA, Iannucci V, Rodgers A, Wang N, LeGrand KE, Sorensen RJD, He J, Zheng P, Aravkin AY, Hay SI, Murray CJL, **Roth G**.

“Generation of human iPSC line from an arrhythmogenic cardiomyopathy patient with a DSP protein-truncating variant”

Loiben A, Friedman CE, Chien W, **Stempien-Otero A**, **Lin S**, **Yang KC**

“dATP Elevation Induces Myocardial Metabolic Remodeling to Support Improved Cardiac Function”

Mhatre KN, Murray JD, Flint G, Webber G, McMillen TS, Shakeri M, Tu A-Y, Steczina S, Weiss R, Raftery D, Tian R, Marcinek DJ, **Murry CE**, **Moussavi-Harami F**, Regnier M.

“Safety and tolerability of nicotinamide riboside in heart failure with reduced ejection fraction”

Wang DD, Airhart SE, Zhou B, Shireman LM, Jiang S, Melendez Rodriguez C, Kirkpatrick JN, Shen DD, Tian R, **O’Brien KD**

14

Cardiac Biology, Vascular Biology,
Population Health, and Clinical
Research Labs as of 2022



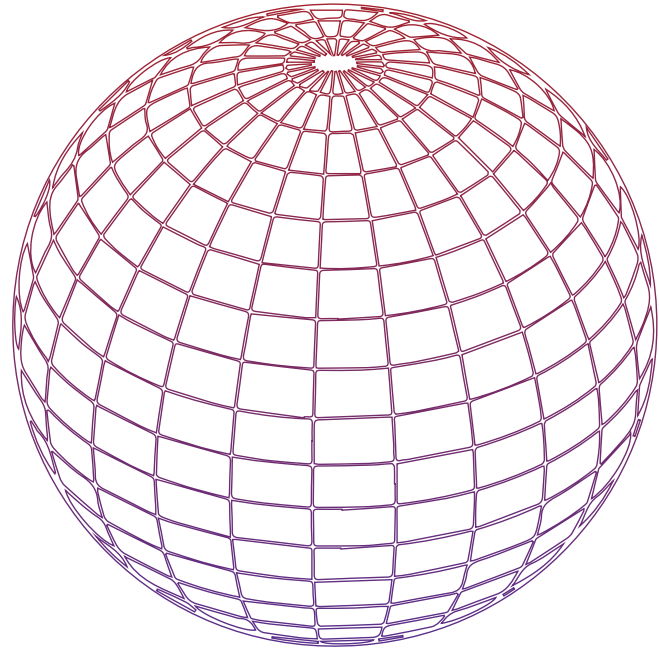
394

2022 Peer Reviewed
Publications

Research Highlights

The Global Burden of Disease: a critical resource for informed policymaking.
Led by Dr. Gregory Roth

This landmark multinational research study is in its third decade. Dr. Roth's team uses their results to provide evidence to improve health policy decisions by governments, including new work examining disparities in the United States. The Cardiovascular Health Metrics program also maintains a research core analyzing registries of patients with heart and vascular disease, to make sure that we learn more from our clinical practice. These analyses help us to keep improving patient care with the experience of thousands of hospitals around the country.



Epicardial adipose tissue is associated with left atrial volume and fibrosis in patients with atrial fibrillation. Led by Dr. Nazem Akoum in collaboration with UW Bio-Engineering

Dr. Akoum's latest study illuminates why some people who have an embolic stroke of undetermined source do not also have abnormal heart rhythms, even though their hearts contain scar tissue similar to people diagnosed with atrial fibrillation (AFib).

His team simulated stress tests on 90 MRI-based computer models of actual hearts: 45 from patients who had an embolic stroke of undetermined source and 45 from those who had AFib but had not yet received treatment. They found that some stroke patients harbor heart scar tissue that's primed for abnormal rhythms—which suggests they may benefit from additional preventive treatment.

Alongside bioengineer Patrick Boyle, they explain why these simulations are important for people who have strokes but whose symptoms don't currently support the prescription of strong anticoagulants.

Directory of Services

Advanced Imaging

- Valve Clinic
- CardioPulmonary Exercise Testing

Adult Congenital Heart Program

- Cardio-Obstetrics Clinic
- Palliative Care Program
- Aortopathy Clinic
- Cardiac Genetics Clinic

Electrophysiology

- Atrial Fibrillation Program
- Multidisciplinary Complex Ablation Program

Advanced Heart Failure

- Cardiogenic Shock Program
- Cardio-Oncology
- Heart Transplant
- Mechanical Circulatory Support - LVAD

Cardiac Surgery

- Multidisciplinary Thoracic Aortic Program
- Mitral Valve Reference Center
- Valve Disease

Interventional Cardiology

- Structural Heart Program
- Complex Coronary Program
- Cardiovascular Innovation Lab

Connect with UW Medicine Heart Institute



Scan me!

<https://linktr.ee/uwheart>



UW Medicine

HEART INSTITUTE
