

*Pulse of  
the **Future***



## Foreword

The National University Heart Centre, Singapore (NUHCS) is one of the two National Specialty Centres in Singapore dedicated to treat patients with complex cardiovascular conditions. Our purpose is to provide tertiary and quaternary level of care that draws upon the strengths of multidisciplinary specialist teams. These teams work closely to provide our patients with high quality, consistent, co-ordinated and individualized care. We recognize that cardiovascular disease represents multifactorial convergence of risk factors and other chronic diseases, and a holistic strategy is essential to address the medical needs of our patients.

NUHCS is privileged to belong to a larger medical fraternity, within an Academic Medical Centre, which is the National University Health System (NUHS). This brings together a wide pool of resources, presenting ample opportunities to conduct cutting edge research in cardiovascular health. At the same time, we can continue to train and prepare the next generation of students and specialists in this fast evolving field through our many education programs in both undergraduate teaching as well as residency programs for post graduate specialty training.

Our patient demographics are rapidly changing and this poses very unique challenges for us to quickly evolve and innovate new paradigms in healthcare delivery. We have begun leveraging new tools in telehealth to remotely monitor our patient's health; enabling us to detect early warning signs of deterioration and begin early intervention.

Our current research in heart failure is also designed to gather important clues into population health that can add to the current body of knowledge regarding the etiology of heart failure. This has far-reaching implications in the way we manage this disease and the design of new intervention methods. Spearheaded by the Cardiovascular Research Institute (CVRI) under both its Centre grant and Translational Clinical Research Flagship programs, we aim to achieve excellence in all aspects of Heart Failure under NUHCS. This includes upstream research that can translate into pioneering treatment modalities for our heart failure patients.

All these innovations will enable us to achieve our intended goal, which is to shape the future of cardiovascular health.

**Associate Professor Tan Huay Cheem**  
Director  
National University Heart Centre, Singapore



### Who We Are

The National University Heart Centre, Singapore (NUHCS) is a leading centre in Singapore and the region, providing specialised and dedicated cardiovascular healthcare services to our patients. We provide a comprehensive and holistic approach to the treatment of cardiovascular disease by assembling multidisciplinary teams that work cohesively to deliver seamless care across medical disciplines.

### What We Do

The goal of the NUHCS is to provide world class specialised and dedicated cardiovascular healthcare services that incorporate the best skills, clinical practice and equipment that will make a difference in the lives of our patients. In all that we do, improving patient outcomes is central to our mission.

The NUHCS provides a broad range of cardiovascular services, from screening and diagnosis to treatment, complemented by long-term care and support group programmes for our patients.

It focuses on six critical areas of cardiovascular care:

- Heart Failure
- Congenital Heart Disease
- Acute Coronary Syndrome
- Vascular Disease
- Women's Heart Health
- Heart Rhythm Disorder

These six core clinical programmes were carefully selected due to their relevance and strategic importance in light of Singapore's ageing population.

# Pulse of the Future

## Patient Care

The NUHCS believes in providing patients with care and support beyond the clinic setting. CHAPPS, which stands for Congenital Heart Association for Patients' and Parents' Support, is a paediatric congenital heart disease support group. The launch of the group is to provide emotional support and offer a helping hand to paediatric patients and their families as and when needed.

The NUHCS is also committed to educating the public on medical problems of the heart. Our doctors partake in health seminars and interview segments with the media to inform the public on general cardiovascular health. With increased public awareness, more people can practise preventive measures and undergo health screening to detect heart diseases in their early and most treatable stages.



## Research

Creating new knowledge through research to bring about betterment of care for our patients is another key mission of the NUHCS. Our two important strategies are to expand our research intellectual capital, increasing the pool of our clinician-scientists and investigators and to focus on high-end research activities. In this regard, the establishment of the Cardiovascular Research Institute (CVRI) provides coordination, leadership and resources to progress both basic and applied cardiovascular research.

### ■ Cardiovascular Research Institute (CVRI)

The portfolio of CVRI research is broad to encompass different types of research, ranging from experimental laboratory-based research, clinical research, clinical trials, health services research, to prevention and epidemiology research. These projects contribute new knowledge from the laboratory to the clinic in support of the NUHCS core clinical programmes.

With an aim to fulfil the tripartite mission of clinical care, research and, the CVRI works in close collaboration with renowned local research institutes, universities both local and overseas.

Extensive networking is also being developed with many other departments and faculties within the hospital and the NUS as well as with faculties of bioengineering in other institutions. A growing number of links (for joint projects and exchange of post graduate staff) with institutions in the US, UK, Europe and Australasia ensure that the NUHCS maintains a global perspective as it pursues research of relevance to cardiovascular diseases in Singapore and elsewhere.



## Education

The NUHCS will continue to build on its strong position as a local and global training centre. Comprehensive training programmes including Fellowship Schemes, Observer Schemes, Continuing Medical Education (CME) Programme and Medical Training are designed to equip fellows with relevant cardiovascular knowledge and skills. Our subspecialty training for both local and overseas cardiologists has been successful in training more than 100 foreign cardiologists and cardiothoracic and vascular surgeons. The NUHCS is committed to educate and train the next generation of healthcare providers by supporting clinical teaching for undergraduate medical students and serving as a clinical and research base for the Yong Loo Lin School of Medicine, NUS. We remain committed to explore future potential collaborations with other tertiary institutions in the pursuit of knowledge sharing.

### ■ Undergraduate teaching

NUHCS is actively involved in the undergraduate medical teaching curriculum of the Yong Loo Lin School of Medicine. We employ state of the art simulation robots to impart finer skills in cardiovascular examination to pre-clinical students. Clinical students in medicine are rotated through ward and clinic postings to expose them to the broad spectrum of cardiology and surgical conditions. Dedicated bedside teaching and courses help prepare students for their final MBBS examination. At the same time we run an elective program for both local and foreign students with special interests in cardiology to pursue research opportunities and additional clinical exposure.

### ■ Cardiology Senior Residency Program

The NUHS Cardiology Senior Residency programme aims to develop our senior residents into committed cardiologists dedicated to compassionate and high quality patient-centered care. One of the outstanding features of the program include the exposure to broad case-mix and diverse patient population which will help better equip our senior residents in handling more complex cases. They are trained under the guidance of experienced and committed clinicians who also have an interest in academia. The majority of our clinicians take on multiple roles – serving as doctors, researchers and educators in the Yong Loo Lin School of Medicine at the National University of Singapore (NUS). These roles enable our senior residents to establish the necessary foundation in achieving proficiency in all aspects of their training and graduate eventually as both clinically astute and caring cardiologists.

### ■ Nursing Education

With diversified services and care required in cardiovascular management, and the rapid development in these areas, nursing professionals need to be equipped with knowledge and skills to manage patient care efficiently. Training of cardiovascular nurses through our comprehensive nursing programmes, and capitalising on the unique set-up of our critical care nursing laboratory for simulated training has helped to build a strong and capable team of nurses within our centre.

## Core Clinical Programmes



In line with its holistic approach to patient care, the NUHCS has six comprehensive clinical programmes that draw on a broad range of expertise to help patients achieve better outcomes.

### Heart Failure Programme:

#### A model for disease management programme

NUHCS Heart Failure (HF) Programme provides a multi-disciplinary, holistic healthcare delivery platform for patients with HF syndromes. The programme consists of HF specialists, HF case managers, pharmacists, physiotherapists, and psychiatrists, working in close relationship with dietitians and specialists from other sub-specialties.

In an acute setting, our surgeons from the Department of Cardiac, Thoracic and Vascular Surgery (CTVS) work in partnership with our cardiologists from the Department of Cardiology to provide emergency life support measures, such as extracorporeal membrane oxygenation (ECMO) implantation, for both paediatric and adult patients. Our team of intensivists are experts in monitoring and guiding ECMO therapy, even for prolonged periods of time. Our ECMO educational program for doctors, nurses and perfusionists is widely recognised as being unparalleled in the region.

Our adapted surgeries, such as Minimally Invasive and Transcatheter Aortic Valve Implantation (TAVI) procedures aim to treat by reducing trauma and stress to severely ill patients and facilitating faster mobilization and recovery. It offers patients a viable alternative mode of treatment when open heart surgery is deemed too risky for our sickest patients.

The cornerstone of the NUHCS HF Programme is the HF specialist-run multi-disciplinary clinics. They include Heart Failure with Preserved Ejection Fraction (HFpEF) Clinic, HF Rehabilitation Program, HF Arrhythmia and Devices Clinic, and Cardiomyopathy Clinic. The diversification and sub-specialization of the umbrella NUHCS HF Program enhances and streamlines the comprehensive approach to diagnostics, therapy and rehabilitation of all forms of HF syndromes. The NUHCS HF Programme is committed to provide only the highest quality of evidence based care to patients. Outcome events such as 30-day and 6-month readmissions, inpatient and intermediate-term deaths are tracked constantly to ensure the best outcome for the patients.

### Congenital and Structural Heart Disease Programme:

#### Span-of-life care

Patients under this programme at the NUHCS benefit from a continuum of care that spans from children to adults. Our paediatric cardiothoracic surgeons and paediatric cardiologists follow through patients with congenital heart defects through their surgeries and developmental phases to adolescence and transition them to our adult congenital heart service. Under the care of a multidisciplinary team of specialists, hopeful parents with a history of congenital heart disease (CHD) are offered prenatal testing and genetic counselling to guide their decisions on having children; expectant mothers undergo antenatal screening and imaging to check for proper development of their fetuses and newborns are screened for CHD.

Under this programme, the NUHCS provides specialised care for patients with:

- Adult Congenital Heart Disease
- Heart Arrhythmia
- Heart Failure
- Pulmonary Hypertension
- Pregnancy and Heart Disease
- Marfan Syndrome

The programme also offers expanding treatment options such as:

- Transcatheter Aortic Valve Implantation (TAVI)
- Mitraclip Therapy
- Left Atrial Appendage (LAA) Closure Device
- Percutaneous Paravalvular Leak Device Plug
- Percutaneous Balloon Valvuloplasty
- Percutaneous Mitral Commissurotomy

The NUHCS also carries out surgeries for congenital heart conditions and percutaneous procedures (implanting devices and sealing congenital defects without open heart surgery). These are some of the distinctive skills that set the NUHCS apart from other medical centres that help meet the growing demand for CHD services in the Asia Pacific region.

### Acute Coronary Syndrome Programme:

#### Timely help for heart attack patients

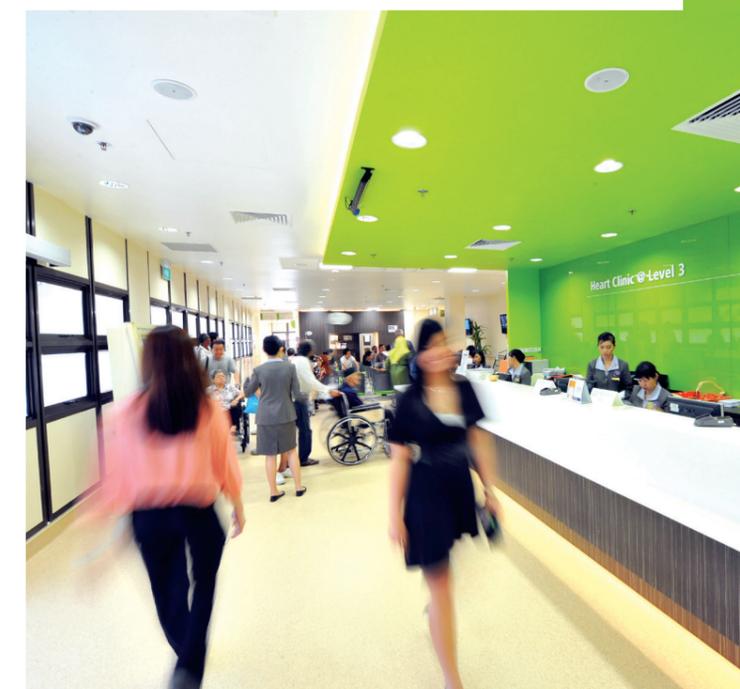
The NUHCS team has been working together with the nurses and specialists from the NUH Emergency Department to reduce the time it takes to diagnose a patient suffering a heart attack to the moment when the coronary vessel is unblocked through 'ballooning' or angioplasty. This is termed door to balloon time and the shorter the time it takes to reopen the blocked artery, the better the outcome for the patient

To improve the care delivery process, the Singapore Civil Defence Force ambulance teams are involved to administer pre-hospital electrocardiograms (ECG) for patients who are suspected with heart attacks while alerting the cardiac interventional team before arriving at the hospital.

Treatment outcome indicators attained by NUHCS have been promising:

- Median 'door-to-balloon' time in NUHCS is **57 minutes\***
- **83%\*** of patients were treated within 90 minutes

\* Figures accurate as of year 2012





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### Vascular Medicine and Therapy Programme:

#### Saving limbs and prolonging life

The lack of awareness for atherosclerosis (hardening of the arteries) often leads to patients seeking late treatment for related ailments that involve the brain, heart, kidney and lower leg arteries. This results in a higher incidence of lower limb amputation, diseases of the heart and blood vessels as well as death. The Vascular Medicine and Therapy Programme brings together specialists from cardiovascular medicine, vascular surgery, radiology, neurology and nephrology to provide personalised care for patients including:

- Medical therapy
- Minimally invasive endovascular techniques
- Modification of risk factors
- Non-invasive diagnostic testing
- Vascular surgery

One key component of the programme is limb preservation service. By introducing a personalised patient care plan comprising of cardiologists and vascular surgeons, the NUHCS aims to reduce the rate for lower limb amputation.

### Women's Heart Health Programme: Fighting heart disease in women

Cardiovascular disease (heart disease and stroke) is the Number 1 killer of women in Singapore. Heart disease in women is not identical to that in men: some conditions affect women more than men (such as diastolic heart failure, apical ballooning syndrome or 'broken heart syndrome'). Even with the same disease, presenting symptoms may be less obvious in women or the underlying mechanisms may be different, thus posing higher risks to women.

The NUHCS offers, for the first time in Singapore, a programme dedicated to women with and at risk of heart disease. The Women's Heart Health Programme aims to provide a comfortable "one-stop" environment for evaluation and management of their cardiovascular risk factors and conditions, raise awareness of the importance of heart disease in women and provide a potential database for research into cardiovascular disease in women.

The services that the Women's Heart Health Programme offers include:

- Cardiac diagnostic evaluation
- Education
- Specialty management
- Risk assessment

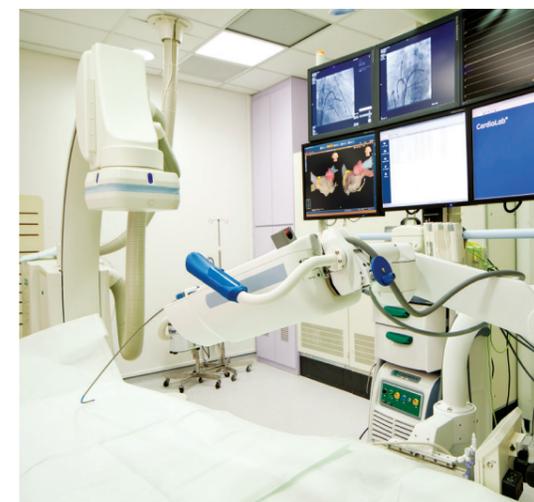
### Heart Rhythm Programme: Arrhythmia Service

Heart rhythm disorders (arrhythmias) are common in the general public as well as in heart patients. Diagnosis of arrhythmias may require non-invasive tests (such as ambulatory ECG monitoring, tilt table test, signal averaged ECG) and/or invasive procedures (such as electrophysiologic study and implantable loop recorder).

Inappropriately slow heart rhythms (bradycardia) and conduction blocks are increasingly common with an ageing population. Treatment may involve the implantation of a pacemaker to maintain the heart rate. Specialised (biventricular) pacemakers may be indicated in heart failure to "resynchronise" the heart leading to an improvement in heart function, reduction in heart failure hospitalisation and improvement in survival. Implantable cardiac defibrillators (ICDs) improve survival in patients at high risk of sudden death.

Abnormally fast heart rhythms (tachyarrhythmias) may be responsive to cure via electrophysiologic study and ablation. These complex procedures are available only in tertiary cardiovascular centres such as the NUHCS, which has extensive experience in these cardiovascular services and is a regional referral centre for arrhythmia and heart failure related disorders.

The recent development in electrophysiology robotic catheter system at the NUHCS introduces a robotic catheter control to overcome limitations of human capability in minimally invasive procedures. With the advancement in technology, the interventional technique can now be done with greater efficiency and accuracy.



## Our Services and Facilities



### Heart Clinics @ NUHCS

The Heart Clinics are specialist outpatient clinics providing expert advice and care for heart conditions. In these clinics, professionals in the disciplines of Cardiology and Cardiac, Thoracic & Vascular Surgery work hand-in-hand to provide seamless care to our patients.

Consultation services include the following:

- Arrhythmia & Pacemaker Management
- Cardiac Rehabilitation Programme
- Cardiac Specialties (Structural Heart Diseases and Pulmonary Hypertension)
- Cardiac, Thoracic & Vascular Surgery
- General Cardiology
- Heart Failure Disease Management



### Diagnostic Cardiac Laboratory

The Diagnostic Cardiac Laboratory is staffed by a multidisciplinary team of cardiologists, nurses, medical technologists and technicians to provide non-invasive diagnostic investigations for our patients.

Investigations and procedures performed by the Diagnostic Cardiac Laboratory include:

- 24-Hour Ambulatory ECG Monitoring
- Ambulatory Blood Pressure Monitoring
- Cardiopulmonary Exercise Test
- Dobutamine Stress Echocardiography
- Exercise Stress Echocardiography
- Permanent Pacemaker Check
- Signal Averaged ECG Test
- Tilt-Table Test
- Transoesophageal Echocardiography
- Transthoracic Echocardiography
- Treadmill Exercise Stress Electrocardiography Test

### Diagnostic Vascular Laboratory

The Diagnostic Vascular Laboratory provides comprehensive assessment of vascular disease. Patients with carotid, aortic, arterial and venous disorders are assessed with vascular ultrasound by experienced vascular technologists.

Investigations and procedures performed by the Diagnostic Vascular Laboratory include:

- Pseudoaneurysm Scans
- Treatment of Varicose Veins
- Ultrasound (duplex scan) for Carotid Arteries
- Vascular Doppler Ultrasonography
- Vein Mapping Service for Dialysis Access Creation



### Pharmacy @ Heart Clinic

Pharmacy @ Heart Clinic caters to the patients of NUHCS. Patients will be able to collect their medications after their consultation. With the pharmacy located within the Heart Centre, it provides immediate accessibility and convenience for heart patients

### Heart Rehab

Heart Rehab is NUHCS' dedicated gym for patients in our Cardiac Rehabilitation programme. Our Cardiac Rehabilitation programme includes exercise training, education and counselling. In this gym, exercise training is conducted using equipment such as the treadmill and exercise bikes under close supervision by our professional physiotherapists. The intent is to provide a safe environment whereby our patients can engage in a healthy and active lifestyle which incorporates exercise within their daily routines.

### Angiography Centre

The Angiography Centre comprises of a dedicated team of expert cardiologists, specialty trained nurses and radiology technologists. The Centre has advanced laboratories that perform diagnostic and coronary, peripheral, valvuloplasty and congenital interventional procedures. It has also developed into a one-stop centre where patients register, receive their procedure, rest and recover and finally leave for home directly from the centre. The Angiography Centre specialises in complex minimally invasive cardiac procedures which have become viable alternatives to open heart surgeries due to their ability to allow quicker recovery for our patients.

### Nuclear Cardiology Laboratory

The Nuclear Cardiology Laboratory performs non-invasive heart studies, using safe radioactive material, to accurately determine the blood flow to the heart muscle and other functions of the heart.

Procedures performed in the Nuclear Cardiology Laboratory include:

- Dobutamine Stress Myocardial Perfusion Imaging Test
- Exercise Stress Myocardial Perfusion Imaging Test
- Multigated Acquisition (MUGA) Scan
- Vasodilator Stress Myocardial Perfusion Imaging Test



### Surgical Service

A team of dedicated surgeons, intensivists, anaesthetists, nurses, perfusionists and allied health professionals committed to a multiprofessional and multidisciplinary approach to patient care. Our services include surgical treatments for:

- Atrial Fibrillation
- Aortic and Peripheral Arterial Disease
- Congenital Heart Disease
- Coronary Artery Disease
- Heart Failure
- Heart Valve Disease
- Lung Cancer and other Thoracic conditions

To enable more complex procedures to be performed more efficiently and with better outcome, the "Hybrid" Operating Theatre combines all the features of a standard operating room with state of the art imaging to provide a surgically sterile and radiation-reduced environment. It offers a new paradigm whereby both cardiology and surgical skills intersect literally into one operation and saves our patients the stress of undergoing two different procedures and reduces downtime with faster recovery time.



### Cardiothoracic Intensive Care Unit (CTICU) Ward

The CTICU ward provides specialised post-operative care for adult and paediatric patients who require the following treatments:

#### Cardiac Surgery:

Coronary Surgery, Valve Surgery, Congenital Heart Surgery and Surgery for Heart Failure

#### Thoracic Surgery:

Pulmonary Surgery and General Thoracic Surgery

#### Vascular Surgery:

Peripheral Vascular Surgery and Endoluminal Treatment, Vascular Access Surgery and Surgery for Aneurysms and Carotid Disease

The patients in the CTICU ward are managed by specialists comprising of cardiac intensivists, anaesthetists and cardiothoracic surgeons. In collaboration with highly trained and dedicated critical care nurses, they provide the required specialised management. The ward has 11 Intensive Care Unit (ICU) beds for acutely ill patients and 4 High Dependency (HD) beds for patients who do not require breathing support.

### Coronary Care Unit (CCU) Ward

The Coronary Care Unit (CCU) ward is a 24-bed unit with state of the art technology and equipment, comprising of 8 ICU beds and 16 HD beds. The ward is designed to limit stress to each patient, ensuring that they receive appropriate care for optimal recovery. Continual monitoring, specialized diagnostic treatments and specialized intensive care nursing are expected at the CCU ward to look after patients with different heart conditions, such as heart failure, acute myocardial infarction and cardiac arrest.



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#### Cardiac Monitoring Unit (CMU)

The Cardiac Monitoring Unit (CMU) is a 6-bed unit within the CCU ward giving dedicated attention to post-elective percutaneous coronary intervention (PCI) patients. Patients recuperate in CMU for a night before getting discharged the next day.

#### Department of Cardiology & Cardiac, Thoracic and Vascular (CTVS) General Wards

Ward 63 and Ward 64 are our Cardiology and CTVS wards. Dedicated patient care and management is achieved through the specialisation of these two wards.





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## Contact Information

### National University Heart Centre, Singapore

1 Main Building of NUH  
 Opening Hours: 8:30 am – 6:00 pm (Monday – Friday)  
 Closed on Weekends & Public Holidays

Website: [www.nuhcs.com.sg](http://www.nuhcs.com.sg)

**You Tube:** [www.youtube.com/user/NUHCS](https://www.youtube.com/user/NUHCS)

### For appointments, please contact:

Tel: (+65) 6772 2002  
 Email: [appointment@nuh.com.sg](mailto:appointment@nuh.com.sg)

### For International Patients and Visitors

The International Patients Liaison Centre (IPLC) is a one-stop service centre to support the needs of our foreign patients and visitors.  
 24-Hour Helpline: (+65) 6779 2777  
 Email: [iplc@nuh.edu.sg](mailto:iplc@nuh.edu.sg)

## Getting to NUH

### Circle Line Kent Ridge MRT Station

Commuters can transit at the Buona Vista MRT Interchange and alight two stops after at the Kent Ridge Station. The station will be served by three exit-entry points

**Exit A:** Right at the doorstep of National University Heart Centre, Singapore.

**Exit B:** Along South Buona Vista Road, which links to Singapore Science Park 1.

**Exit C:** Leads to NUH Medical Centre.