Cardiology

Advanced Training Curriculum

Adult Medicine Division

The Royal Australasian
College of Physicians

The Cardiac Society of
Australia and New Zealand

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The process was managed by the Curriculum Development Unit within the College's Education Deanery, who designed the document, drafted content material, organised and facilitated writing workshops, developed resource materials, and formatted the final document.

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Physician Readiness for Expert Practice (PREP) Training Program

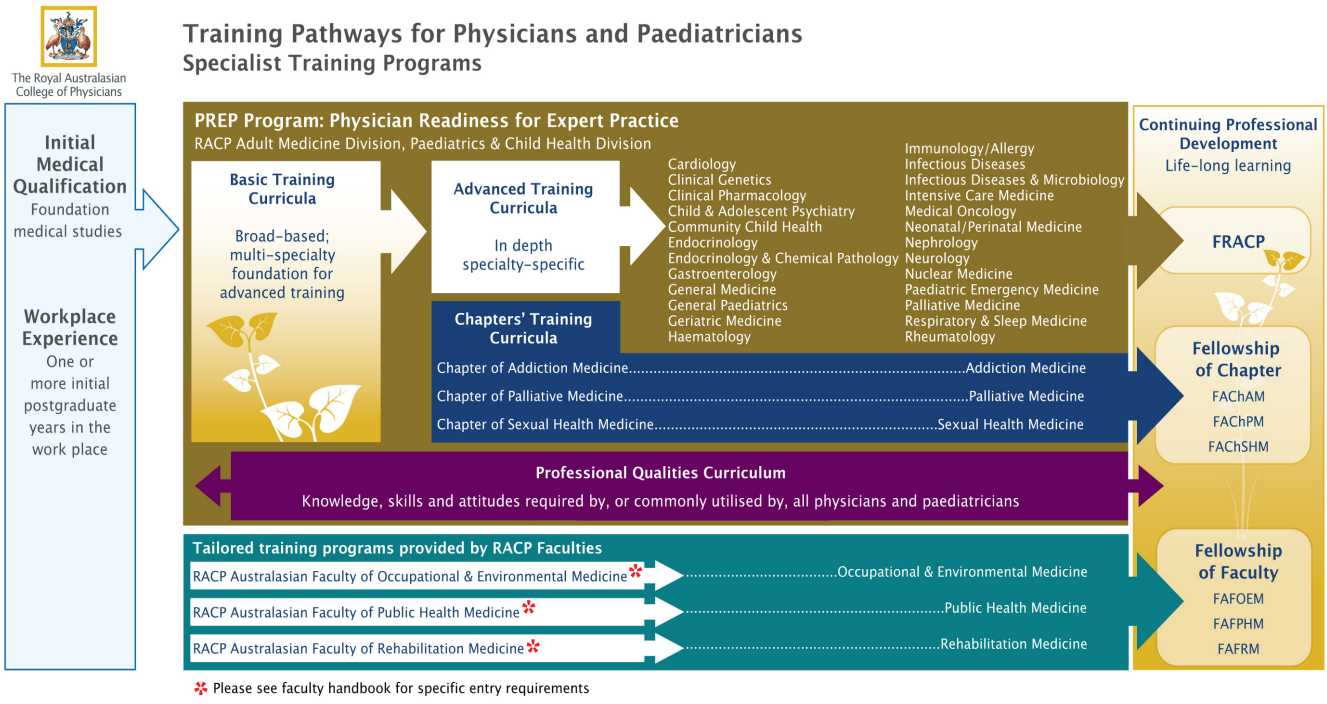
Cardiology Advanced Training Curriculum

To be used in conjunction with:

Basic Training Curriculum – Adult Internal Medicine

Professional Qualities Curriculum

PHYSICIAN AND PAEDIATRICIAN TRAINING CONTINUUM OF LEARNING



The schematic depicts the interrelationship between the various RACP Training program curricula components. In particular it emphasises the underpinning nature of the Professional Qualities Curriculum.

It also reinforces the link from initial medical training through PGY1/2, leading into Basic/Advanced/Faculty/Chapter training and following on into Continuing Professional Development (CPD).

OVERVIEW OF THE SPECIALTY

Cardiology is a branch of internal medicine concerned with prevention, investigation and therapy of, and research into, diseases involving the cardiovascular system.

Cardiovascular disease remains the leading cause of death within our society. The economic burden to society resulting from lost productivity, health care costs and costs of care for people disabled by cardiovascular disease consumes up to twenty five per cent of the health budget.

Cardiologists are the largest specialty group within the Royal Australasian College of Physicians. The spectrum of cardiovascular disease is such that cardiologists have close working relationships with a broad range of other internal medicine physicians and with vascular and cardiothoracic surgeons. Cardiology is well recognised as a research-intensive field, from which many leading biomedical researchers have arisen.

Cardiologists are perceived, by the public, as important members of the medical profession, who can effectively treat heart disease and return patients to active lives. They are also perceived as advocates for healthy lifestyles, including diet and physical activity. One perhaps unfortunate consequence is that there is a broad public perception that cardiology can now cure all cardiovascular problems and there is some complacency about heart disease within the population.

The emerging fields of molecular cardiology and tissue regrowth/engineering will open exciting new avenues for treatment of most cardiovascular diseases. These will require cardiologists with new skills and a broader knowledge base than previously.

CURRICULUM OVERVIEW

Adult Cardiology – Advanced Training Curriculum

This Curriculum outlines the broad concepts, related learning objectives and the associated theoretical knowledge, clinical skills, attitudes and behaviours required and commonly utilised by cardiologists within Australia and New Zealand.

The purpose of advanced training is for trainees to build on the cognitive and practical skills acquired during basic training. At the completion of the adult cardiology advanced training program, trainees should be competent to provide at consultant level, unsupervised comprehensive medical care in cardiology.

Attaining competency in all aspects of this curriculum is expected to take three years of training. It is expected that all teaching, learning and assessment associated with the cardiology curriculum will be undertaken within the context of the physician's everyday clinical practice and will accommodate discipline-specific contexts and practices as required. As such it will need to be implemented within the reality of current workplace and workforce issues and the needs of health service provision.

There may be learning objectives that overlap with or could easily relate to other domains; however, to avoid repetition, these have been assigned to only one area. In practice, however, it is anticipated that within the teaching/learning environment, the progression of each objective would be explored.

Note: The curricula should always be read in conjunction with the relevant College Training Handbook available on the College website.

Professional Qualities Curriculum

The Professional Qualities Curriculum (PQC) outlines the range of concepts and specific learning objectives required by, and utilised by, all physicians, regardless of their specialty or area of expertise. It spans both the Basic and Advanced Training programs and is also utilised as a key component of the Continuing Professional Development (CPD) program.

Together with the various Basic and Advanced Training Curricula, the PQC integrates and fully encompasses the diagnostic, clinical, and educative-based aspects of the Physician's/Paediatrician's daily practice.

Each of the concepts and objectives within the PQC will be taught, learnt and assessed within the context of everyday clinical practice. It is important, therefore, that they be aligned with, and fully integrated into, the learning objectives within this curriculum.

Supervisor Reports

These have been the principal assessment tool for cardiology trainees for many years and will continue to be an important assessment tool. The report forms have been revised, to provide improved opportunity for assessment of both generic skills and also of specific knowledge, skills and procedures for training in cardiology.

Each trainee will be required to have two supervisor reports submitted each year. The first report will be an interim progress report and largely formative, and the second report will be the summative report for the year. The supervisor reports will be expected to reflect the regular training reviews conducted between trainee and supervisor each quarter.

Logbooks

Trainees are required to maintain a logbook of clinical procedures performed over the course of their training.

Logbooks must reflect precise numbers of procedures performed, including information on whether the procedures were supervised or not.

The logbook can be used as a tool to indicate where further exposure is required. Trainees and supervisors can use the logbook to identify gaps and plan for adequate exposure to the required clinical procedures.

Completion of the indicated minimum number of procedural skills will ensure that the trainee gains a broad basic experience of procedures and is a requirement of the Advanced Training Program.

Supervisors will review trainees' logbooks at regular intervals and confirm in their reports that the logbook is a true and accurate record of trainees experience and that all training requirements have been fulfilled.

The Specialist Training Committee (STC) in Cardiology may require trainees to submit their logbook for review at any time over the course of the training program.

Trainees are required to keep logbooks documenting procedures in:

- Holter Monitors
- Exercise Tests
- Echocardiograms *(transoesophageal and transthoracic)*
- Direct Current Reversion
- Temporary Transvenous Pacemaker Insertion
- Permanent Pacemaker Function Testing
- Right Heart Catheterisation
- Coronary Angiography
- Pericardial Aspiration
- Electrophysiological Studies and Ablation Techniques

Trainees will also be required to log cardiothoracic surgical cases, and the number of outpatients they have seen over the course of their core training in their logbooks.

EXPECTED OUTCOMES AT THE COMPLETION OF TRAINING

Graduates from this training program will be equipped to function effectively within the current and emerging professional, medical and societal contexts. At the completion of the advanced training program in adult cardiology, as defined by this curriculum, it is expected that a new Fellow will have developed the clinical skills and have acquired the theoretical knowledge for competent cardiology practice. It is expected that a new Fellow will be able to:

- utilise effective communication with patients and their families and with professional colleagues
- be devoted to life long learning
- be equipped to manage both acute and chronic cardiac disease
- identify the pathophysiology and manifestations of cardiovascular disease, and modern therapeutics, which can be applied to patient diagnosis and management
- apply appropriate skills to perform necessary diagnostic and therapeutic procedures
- use best available evidence to support diagnostic and therapeutic decisions
- demonstrate a capacity to rationally analyse clinical data and published work
- demonstrate an understanding of and commitment to the role of research in advancing medical care of cardiovascular disease
- develop a commitment to compassionate, ethical professional behaviour
- identify cardiovascular health issues of importance to the community and contribute constructively to debate about those issues
- apply primary and secondary prevention strategies in cardiac disease.

CURRICULUM THEMES AND LEARNING OBJECTIVES

Each of the curriculum documents has been developed using a common format, thereby ensuring a degree of consistency and approach across the spectrum of training.

Domains

The Domains are the broad fields which group common or related areas of learning.

Themes

The Themes identify and link more specific aspects of learning into logical or related groups.

Learning Objectives

The Learning Objectives outline the specific requirements of learning. They provide a focus for identifying and detailing the required knowledge, skills and attitudes. They also provide a context for specifying assessment standards and criteria as well as providing a context for identifying a range of teaching and learning strategies.

Minimum Practical Performance Requirements

These outline the minimum set of practical performance requirements to be met. They provide a benchmark for trainees and supervisors to incorporate into their teaching and learning strategies. The minimum practical performance requirements will need to be reached prior to completion of this training program.

LEARNING OBJECTIVES TABLES

DOMAIN 1	**SCIENTIFIC BASIS OF CARDIOLOGY**
Theme 1.1	**Basic Principles in Cardiology**
Learning Objectives	
1.1.1	Explain cardiac physiology and anatomy
1.1.2	Explain cardiovascular biochemistry
1.1.3	Apply clinical skills to diagnose and manage heart conditions and diseases
Theme 1.2	**Research**
Learning Objectives	
1.2.1	Identify research principles and undertake research projects
Theme 1.3	**Basic and Advanced Life Support**
Learning Objectives	
1.3.1	Perform and supervise the resuscitation of patients

LEARNING OBJECTIVES TABLES

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.1	**Presentations and Manifestations of Cardiovascular Disease**
Learning Objectives	
2.1.1	Assess and treat patients presenting with acute breathlessness
2.1.2	Assess and treat patients presenting with chronic breathlessness
2.1.3	Assess and treat patients presenting with chest pain
2.1.4	Assess and treat patients with acute heart failure
2.1.5	Assess and treat patients with chronic heart failure
2.1.6	Assess and treat patients with pre-syncope and syncope
2.1.7	Assess patients presenting with cardiovascular manifestations of sleep disorders
Theme 2.2	**Heart Diseases and Disorders**
Learning Objectives	
2.2.1	Assess and treat patients with stable angina
2.2.2	Assess and treat patients who are critically ill with haemodynamic disturbances
2.2.3	Assess and treat patients with acute coronary syndromes
2.2.4	Assess and treat patients with, or at risk from, endocarditis
2.2.5	Assess and treat patients with cardiac murmurs and valvular heart disease
2.2.6	Assess and treat patients with arrhythmias
2.2.7	Assess and treat patients with cardiomyopathy
2.2.8	Assess and treat patients with cardiac tumours
2.2.9	Assess and treat patients with pericardial disease
2.2.10	Assess patients with cardiovascular disease prior to non-cardiac surgery
Theme 2.3	**Congenital and Inherited Heart Disease**
Learning Objectives	
2.3.1	Diagnose and manage patients with inherited heart disease
2.3.2	Diagnose and manage patients with common forms of congenital heart disease
Theme 2.4	**Conditions Affecting the Circulation**
Learning Objectives	
2.4.1	Assess and treat patients with hypertension
2.4.2	Assess and treat patients with pulmonary hypertension
2.4.3	Assess and treat patients with acute and chronic thromboembolic disease
2.4.4	Assess and treat patients with diseases of the aorta
2.4.5	Assess and treat patients with systemic vascular disease
2.4.6	Assess and treat patients with lipid abnormalities

LEARNING OBJECTIVES TABLES

Theme 2.5	At Risk Individuals and Groups
Learning Objectives	
2.5.1	Identify and discuss the prevalence of cardiovascular disease in Aboriginal and Torres Strait Islander and Maori and Pacific Islander populations
2.5.2	Manage acute and chronic cardiovascular disease in Aboriginal and Torres Strait Islander and Maori and Pacific Islander populations
2.5.3	Assess and treat heart disease in patients who are pregnant or planning pregnancy
2.5.4	Assess and manage heart disease in elderly patients
2.5.5	Assess and manage heart disease in patients with co-morbidity
2.5.6	Assess and treat patients with risk factors for atherosclerotic vascular disease
2.5.7	Explain the risk of driving following a cardiac illness and advise patients on fitness to drive

Domain 3	Practical Performance, Procedures and Investigations
Theme 3.1	**Electrophysiology (EP) and Pacing**
Learning Objectives	
3.1.1	Describe the indications for electrophysiology study and explain the possible therapeutic options, including use of implantable cardioverter-defibrillators and ablative procedures
3.1.2	Explain the principles of cardiac pacing and application of pacing to patient management
3.1.3	Describe diagnostic and therapeutic electrophysiology
Theme 3.2	**Pericardiocentesis**
Learning Objectives	
3.2.1	Perform pericardiocentesis in the diagnosis and treatment of patients with pericardial disease
Theme 3.3	**Electrocardiography and Holter Monitoring**
Learning Objectives	
3.3.1	Perform and interpret electrocardiography and Holter monitoring procedures
Theme 3.4	**Exercise Testing**
Learning Objectives	
3.4.1	Supervise and interpret exercise testing
Theme 3.5	**Cardioversion**
Learning Objectives	
3.5.1	Perform chemical and direct current cardioversion
Theme 3.6	**Cardiac Catheterisation and Angiography**
Learning Objectives	

3.6.1	Perform and interpret cardiac catheterisation and angiography
Theme 3.7	**Coronary Angioplasty**
Learning Objectives	
3.7.1	Select and manage patients for percutaneous coronary intervention and related techniques
Theme 3.8	**Echocardiography**
Learning Objectives	
3.8.1	Perform and interpret echocardiography
Theme 3.9	**Cardiac Surgery**
Learning Objectives	
3.9.1	Describe the indications for cardiac surgery and manage patients before and after surgery
Theme 3.10	**Radiation and Cross Sectional Imaging**
Learning Objectives	
3.10.1	Use radiation equipment in the diagnosis, assessment and treatment of patients with cardiac disease
3.10.2	Define the indications for nuclear cardiology and interpret the results of common cardiac nuclear medicine investigations
3.10.3	Explain the applications and limitations of cardiac computed tomography (CT) and magnetic resonance (MR) imaging
Theme 3.11	**Ambulatory Care**
Learning Objectives	
3.11.1	Assess and manage patients in the ambulatory care (outpatient) setting

DOMAIN 1	SCIENTIFIC BASIS OF CARDIOLOGY
Theme 1.1	**Basic Principles in Cardiology**
Learning Objective 1.1.1	Explain cardiac physiology and anatomy
Knowledge	
• discuss cardiac pressure including volume relationships • describe the physiology of the pulmonary circulation • describe the physiology of the coronary circulation • describe the physiology of the cardiac conduction system • explain the cardiovascular anatomy • describe the physiology of the respiratory system.	

DOMAIN 1	SCIENTIFIC BASIS OF CARDIOLOGY
Theme 1.1	**Basic Principles in Cardiology**
Learning Objective 1.1.2	Explain cardiovascular biochemistry
Knowledge	
• identify myocardial energy production • explain the autonomous nervous system and cardiovascular neurohormones • recognise the genetics of cardiovascular disorders • describe cardiomyocyte structure and metabolism • outline principles of cardiovascular molecular biology • explain myocardial necrosis and apoptosis • explain the vascular biology of atherosclerosis.	

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 1.1	**Basic Principles in Cardiology**
Learning Objective 1.1.3	Apply clinical skills to diagnose and manage heart conditions and diseases

Knowledge	Skills

• describe the following for common heart conditions and diseases:
  ▪ pathogenesis
  ▪ pathophysiology
  ▪ natural history
  ▪ epidemiology
  ▪ clinical presentations
  ▪ prognosis
• describe the following features of invasive and non-invasive investigations used in the assessment of heart conditions and diseases:
  ▪ indications
  ▪ limitations
  ▪ risks
  ▪ benefits
  ▪ predictive values
• explain the pharmacology of drugs used in various treatments.
	• elicit a history
	• perform an examination
	• select and interpret appropriate investigations
	• identify indications for further investigation and intervention
	• select drug therapy, treatments and interventions for individual patients
	• explain diagnoses, implications, and management strategies to patients and their families.

Teaching and Learning Opportunities
• Emergency department • Coronary care unit • Intensive care unit

DOMAIN 1	SCIENTIFIC BASIS OF CARDIOLOGY
Theme 1.2	**Research**
Learning Objective 1.2.1	Identify research principles and undertake research projects

Knowledge	Skills

• discuss categories of clinical research studies including:
  ▪ randomised controlled trial
  ▪ observational study
  ▪ meta-analysis
  ▪ registry
  ▪ case reports
• explain basic statistical analyses applied to clinical research studies, and levels of evidence applied to clinical trials
• describe the concept of absolute versus relative risks
• explain statistical methodologies as they apply to risk assessment
• critically evaluate research studies
• outline possible approaches to studying a clinical question and design a research study.
	• critically review published research through department journal club and presentations
	• participate in clinical research projects during training period.

Teaching and Learning Opportunities
• Department journal meetings and presentations • Department research meetings

DOMAIN 1	SCIENTIFIC BASIS OF CARDIOLOGY
Theme 1.3	**Basic and Advanced Life Support**
Learning Objective 1.3.1	Perform and supervise the resuscitation of patients

Knowledge	Skills
• describe current guidelines on resuscitation • describe the principles of cardiopulmonary resuscitation • describe the cardiac and non-cardiac causes of cardiac arrest • explain the theoretical basis of cardiopulmonary resuscitation.	• supervise pre-hospital care • initiate and perform Basic Life Support • initiate and perform Advanced Life Support • initiate and perform cardiac defibrillation • perform and supervise resuscitation of patients suffering from cardiac arrests and the critically ill.

Teaching and Learning Opportunities

- Accident and Emergency Department
- In-patient emergencies
- Operating theatre and recovery room
- Advanced Life Support course

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.1	Presentations and Manifestations of Cardiovascular Disease
Learning Objective 2.1.1	Assess and treat patients presenting with acute breathlessness

Knowledge	Skills
• describe causes of acute breathlessness • describe the management of cardiac and non-cardiac diseases presenting with breathlessness • describe the role of assisted ventilation (invasive and non-invasive) in compromised patients • describe the indications for and methods of assisted ventilation, e.g. continuous/bi-level positive airway pressure (CPAP/BiPAP).	• manage urgent clinical presentations of breathlessness, including: ▪ acute pulmonary oedema ▪ major pulmonary thromboembolism ▪ respiratory failure • interpret cardiac causes of breathlessness in an acute setting (e.g. intensive care) • recommend and initiate assisted ventilation in compromised patients (e.g. CPAP).

Teaching and Learning Opportunities
• Emergency department • Coronary care unit • Intensive care unit

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.1	Presentations and Manifestations of Cardiovascular Disease
Learning Objective 2.1.2	Assess and treat patients presenting with chronic breathlessness

Knowledge	Skills
• describe respiratory and cardiac causes of chronic breathlessness • identify treatment methods for pulmonary disease • recognise exertional breathlessness as an angina equivalent • describe management options for chronic breathlessness.	• diagnose and manage patients with chronic breathlessness • refer for lung function tests, such as: ▪ spirometry ▪ diffusing capacity of the lung for carbon monoxide (DLCO) ▪ flow velocity measurements • interpret the results of these tests.

Teaching and Learning Opportunities
• Cardiac ward • In-patient consultations • Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.1	**Presentations and Manifestations of Cardiovascular Disease**
Learning Objective 2.1.3	Assess and treat patients presenting with chest pain

Knowledge	Skills
• explain the causes of chest pain • identify the importance of individual risk factor profiles • discuss the impact of chronic pain syndromes.	• take a history and conduct a clinical examination • select and interpret appropriate investigations • formulate a differential diagnosis.

Teaching and Learning Opportunities

- Emergency department
- Inpatient consultations
- On-call after hours
- Coronary Care unit

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.1	**Presentations and Manifestations of Cardiovascular Disease**
Learning Objective 2.1.4	Assess and treat patients with acute heart failure

Knowledge	Skills
• describe the aetiology, pathophysiology, diagnosis and management of acute heart failure • describe the pharmacology of drugs currently used in the treatment of heart failure • identify complications of pharmacological treatment in patients with heart failure • recognise the role of non-invasive and invasive ventilation • describe indications for referral for intra-aortic balloon pump and percutaneous revascularisation • describe indications for referral for surgical interventions, including valve surgery, cardiac transplantation and assist devices.	• select drug therapy and interventions for individual patients with acute heart failure • manage patients requiring non-invasive ventilatory support.

Teaching and Learning Opportunities

- Cardiac ward
- Coronary care unit
- Intensive care unit
- In-patient consultations
- Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.1	**Presentations and Manifestations of Cardiovascular Disease**
Learning Objective 2.1.5	Assess and treat patients with chronic heart failure.

Knowledge	Skills

• describe the aetiology, pathophysiology, diagnosis and management of chronic heart failure
• describe the natural history and clinical presentation of patients with heart failure
• describe the pharmacology of drugs currently used in the treatment of heart failure
• describe the indications for referral for surgical interventions, including:
  ▪ valve surgery
  ▪ cardiac transplantation
  ▪ assist devices
• describe the role of non-pharmacological treatment including exercise for heart failure
• identify complications of pharmacological treatment in patients with heart failure
• describe the indications for an implantable cardioverter-defibrillator (ICD)
• explain the role of biventricular pacing and resynchronisation therapy.
	• select drug therapy and interventions for individual patients with heart failure.

Teaching and Learning Opportunities
• Cardiac ward • In-patient consultation • Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.1	**Presentations and Manifestations of Cardiovascular Disease**
Learning Objective 2.1.6	Assess and treat patients with pre-syncope and syncope

Knowledge	Skills
• identify causes of syncope and pre-syncope • differentiate between cardiological and non-cardiological causes of syncope • describe autonomic causes of hypotension • outline a risk profile of a patient with syncope • explain the medical management of postural hypotension • describe indications for cardiac pacing and use of ICDs.	• recognise life threatening cardiac causes of syncope • conduct an examination, including carotid sinus massage • select and interpret appropriate investigations including: ▪ Holter monitoring ▪ tilt table testing ▪ implantable electrocardiogram (ECG) monitoring devices ▪ coronary angiography ▪ electrophysiology (EP) studies ▪ assessment for implantable cardioverter-defibrillator (ICD) • develop a management plan for syncopal patients • insert temporary cardiac pacing systems • investigate and manage patients with resuscitated sudden death.

Teaching and Learning Opportunities

- Emergency department
- In-patient consultations
- Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.1	**Presentations and Manifestations of Cardiovascular Disease**
Learning Objective 2.1.7	Assess patients presenting with cardiovascular manifestations of sleep disorders

Knowledge	Skills
• describe the physiology of sleep • identify types of sleep apnoea • describe the cardiovascular manifestations of sleep apnoea • explain the effect of sleep disorders in cardiovascular diseases.	• select and refer for appropriate investigations • refer for specialist assessment and treatment where required.

Teaching and Learning Opportunities
• Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.2	**Heart Diseases and Disorders**
Learning Objective 2.2.1	Assess and treat patients with stable angina

Knowledge	Skills
• describe the pathogenesis of atheroma and the importance of risk factors • describe the natural history, pathophysiology, and presentations of coronary artery disease • describe the pharmacology of drugs currently used in the treatment of stable angina • identify the indications for further investigation and intervention • describe the role of revascularisation procedures, including angioplasty and coronary artery bypass surgery.	• diagnose angina and differentiate from chronic non-cardiac pain • explain risks and benefits of an intervention on a patient • select and initiate appropriate treatment options • identify and manage risk factors for further coronary heart disease.

Teaching and Learning Opportunities
• Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.2	**Heart Diseases and Disorders**
Learning Objective 2.2.2	Assess and treat patients who are critically ill with haemodynamic disturbances

Knowledge	Skills
• describe the pathogenesis, presentation and natural history of critical illness due to haemodynamic disturbance • explain the medical management of a shocked patient • describe the indications and complications of intra-aortic balloon pump counterpulsation • describe the indications for ventricular assist devices • explain the indications for and haemodynamic consequences of positive pressure ventilation • describe the indications for urgent surgical and coronary intervention.	• assess, manage and give advice on the critically ill patient • recognise and manage acute conditions including: ▪ pulmonary embolism ▪ acute pericarditis ▪ myocarditis ▪ cardiac tamponade ▪ aortic dissection ▪ cardiac rupture ▪ cardiogenic shock ▪ post infarction ventricular septal defect and mitral regurgitation ▪ circulatory collapse ▪ septic shock • select and use investigations appropriately to assess haemodynamics including: ▪ echocardiography ▪ pulmonary artery catheterisation ▪ haemodynamic measurements • define the indications and limitations of inotropic drugs • perform urgent pericardiocentesis • insert and manage intra-aortic balloon pump.

Teaching and Learning Opportunities

- In-patient emergencies
- Operating theatre and recovery room
- Emergency department

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.2	**Heart Diseases and Disorders**
Learning Objective 2.2.3	Assess and treat patients with acute coronary syndromes

Knowledge	Skills

• describe the pathophysiology of acute coronary syndromes, including plaque rupture
• describe the diagnosis and management of acute coronary syndromes
• describe the pharmacology of drugs currently used in the treatment of acute and post-coronary syndromes
• describe the indications, interpretation and management of:
  ▪ haemodynamic monitoring
  ▪ left ventricular assist devices
  ▪ intra-aortic balloon pumps
• describe the indications for:
  ▪ thrombolysis
  ▪ drug therapy
  ▪ urgent angioplasty
• recognise when to refer patients for angiography
• manage complications such as arrhythmias, heart failure and shock
• identify coronary care unit protocols.
	• select and manage cardiovascular medications
	• initiate and perform cardiopulmonary resuscitation and life support
	• assess individual patient risk and prioritise patients for urgent intervention
	• perform angiography during the acute phase if indicated
	• insert and manage an intra-aortic balloon pump under supervision
	• manage the clinical and administrative aspects of a coronary care unit.

Teaching and Learning Opportunities

- Emergency department
- Coronary care unit
- On-call after hours
- Intra-aortic balloon pump insertion

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.2	**Heart Diseases and Disorders**
Learning Objective 2.2.4	Assess and treat patients with, or at risk from, endocarditis

Knowledge	Skills

• describe the pathogenesis, presentation and natural history of infective endocarditis
• identify common pathogens associated with endocarditis
• describe the indications and limitations of investigations used in the diagnosis and management of endocarditis, including:
  ▪ trans-thoracic echocardiography
  ▪ transoesophageal echocardiography
• explain the possible complications of endocarditis
• describe the indications for, and timing of surgical intervention
• recognise current guidelines for endocarditis prophylaxis
• explain the investigation and management of device-related infection
• explain the investigation and management of prosthetic valve endocarditis.
	• diagnose, investigate, treat and monitor patients with endocarditis
	• integrate information and advice from clinical microbiologists and cardiac surgeons
	• manage patients with native and prosthetic valve endocarditis.

Teaching and Learning Opportunities

- Emergency department
- In-patient consultations
- Multidisciplinary meetings

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.2	**Heart Diseases and Disorders**
Learning Objective 2.2.5	Assess and treat patients with cardiac murmurs and valvular heart disease

Knowledge	Skills
• describe the pathological processes that are responsible for valvular heart disease • describe the natural history of valve disorders • explain the indications for surgical intervention including valve repair • identify different types of prosthetic valves available for clinical use • recognise anticoagulation regimes for patients with valve disease and prostheses • explain the role of percutaneous intervention in valvular heart disease.	• conduct an examination to accurately diagnose of the valve lesion • interpret physical signs with reference to severity of valve heart disease • perform and interpret a transthoracic echocardiogram • perform and interpret: ▪ right heart catheterisation ▪ left heart catheterisation ▪ haemodynamic measurements.

Teaching and Learning Opportunities

- In-patient consultations
- Ambulatory care
- Cardiac catheter laboratory
- Echocardiography lab

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.2	**Heart Diseases and Disorders**
Learning Objective 2.2.6	Assess and treat patients with arrhythmias

Knowledge	Skills

• describe the following features of arrhythmias:
  ▪ aetiology
  ▪ pathogenesis
  ▪ natural history
  ▪ presentations
  ▪ clinical signs
  ▪ prognosis
  ▪ management options
• identify normal electrophysiology of the heart and the basis of arrhythmogenesis
• describe the pharmacology of drugs currently used in the treatment of arrhythmias
• describe the indications for, and management properties of:
  ▪ temporary pacemakers,
  ▪ single chamber permanent pacemakers
  ▪ dual chamber permanent pacemakers
  ▪ electrophysiological studies
  ▪ radiofrequency ablation
  ▪ ICDs.
	• select drug therapy and interventions for patients with arrhythmias
	• select patients for cardioversion
	• perform cardioversion
	• interpret and evaluate results from ECG
	• insert temporary cardiac pacing systems.

Teaching and Learning Opportunities

- In-patient consultations
- Ambulatory care
- Cardioversion procedures
- Cardiac catheter laboratory

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.2	**Heart Diseases and Disorders**
Learning Objective 2.2.7	Assess and treat patients with cardiomyopathy

Knowledge	Skills

• describe the pathogenesis, natural history and prognosis of cardiomyopathy
• identify different types of cardiomyopathy
• describe genetic basis for cardiomyopathies, including hypertrophic cardiomyopathy
• describe the cardiac complications of viral infections, including HIV
• discuss the role of family screening
• explain the role of the following in the management of patients with cardiomyopathies:
  ▪ screening
  ▪ medical therapy
  ▪ ICDs
  ▪ Pacemakers
  ▪ CRT/resynchronisation therapy
  ▪ catheter based treatment
  ▪ surgical based treatments
• explain the indications for cardiac transplantation
• explain the implications of having a cardiomyopathy on lifestyle activities (e.g. participation in competitive sport).
	• select and interpret appropriate investigations, including:
	  ▪ echocardiography
	  ▪ magnetic resonance imaging (MRI)
	  ▪ exercise testing
	  ▪ cardiac catheterisation and angiography
	  ▪ EP studies
	• manage patients with genetic basis for cardiomyopathy, including:
	  ▪ counselling family members
	  ▪ advising when genetic testing is indicated.

Teaching and Learning Opportunities

- In-patient consultations
- Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.2	Heart Diseases and Disorders
Learning Objective 2.2.8	Assess and treat patients with cardiac tumours

Knowledge	Skills
• describe the pathology, presentation and natural history of cardiac tumours • explain the indications and timing of surgical intervention for specific tumours.	• select and interpret appropriate investigations, including computed tomography (CT) and cardiac MR • perform and interpret transthoracic echocardiograms • recognise the appearance of common cardiac tumours • interpret results of investigations to form a differential diagnosis.

Teaching and Learning Opportunities

- In-patient consultations
- Specialty clinic
- Multidisciplinary meetings

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.2	Heart Diseases and Disorders
Learning Objective 2.2.9	Assess and treat patients with pericardial disease

Knowledge	Skills
• describe the pathogenesis, natural history and prognosis of pericardial diseases • describe modes of presentation of pericardial disease • identify the haemodynamics of constrictive pericarditis and tamponade • explain the indications for investigation in patients with pericardial disease • explain the medical and surgical management of the patients with pericardial disease.	• select and interpret appropriate investigations, including echocardiography and right heart catheterisation • recognise indications for pericardiocentesis • perform pericardiocentesis in appropriately selected patients • recognise and manage cardiac tamponade • recognise and manage pericardial constriction.

Teaching and Learning Opportunities

- Emergency department
- In-patient consultations
- Ambulatory care
- Perform pericardiocentesis

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.2	**Heart Diseases and Disorders**
Learning Objective 2.2.10	Assess patients with cardiovascular disease prior to non-cardiac surgery

Knowledge	Skills
• describe the effects of common anaesthetic agents upon cardiovascular function • describe the issues for patients with devices, such as pacemakers and ICDs, undergoing non cardiac surgery • identify pre-operative relevant cardiac investigations • describe indications for and principles of antibiotic prophylaxis against infective endocarditis • explain the need for cardiac follow-up after surgery • identify pre-operative cardio-vascular pharmacological interventions in patients undergoing non-cardiac surgery.	• assess for patients with cardiac disease prior to non cardiac surgery, including risk assessment of: ▪ anaesthesia ▪ surgery • advise on the ways to minimise the risk of non-cardiac surgery • provide valid and useful risk assessment advice to patients, anaesthetists and surgeons.

Teaching and Learning Opportunities
• In-patient consultations • Operating theatre and recovery room • Pre-operative assessment clinics

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.3	**Congenital and Inherited Heart Disease**
Learning Objective 2.3.1	Diagnose and manage patients with inherited heart disease

Knowledge	Skills

• describe the fundamentals of human inheritance
• recognise the principles of molecular genetics and genetic testing
• describe the genetics of common inherited heart diseases
• identify the molecular pathophysiology of common inherited heart diseases
• describe the clinical presentations, natural history and screening for common inherited heart diseases, including:
  ▪ channelopathies and/or inherited rhythm disturbances
  ▪ cardiomyopathies
  ▪ connective tissues diseases (e.g. Marfan Syndrome)
• identify features of the following inherited conditions:
  ▪ Brugada syndrome
  ▪ long QT syndrome
  ▪ channelopathies
  ▪ cardiomyopathies.
	• elicit and document a detailed family and clinical history to develop a pedigree for disease
	• perform a specific systemic physical examination, including the detection of non-cardiac features
	• interpret the results of genetic tests
	• manage patients with congenital heart disease, including post-surgery
	• counsel individuals at risk of inherited heart disease.

Teaching and Learning Opportunities
• In-patient consultations • Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.3	**Congenital and Inherited Heart Disease**
Learning Objective 2.3.2	Diagnose and manage patients with common forms of congenital heart disease

Knowledge	Skills

• describe the fundamentals of embryology of the heart
• describe the following features of common congenital heart diseases:
  ▪ epidemiology
  ▪ natural history
  ▪ clinical presentations
• recognise the principles of molecular genetics and genetic testing
• explain the role of screening for common congenital heart diseases in at-risk individuals
• explain management principles of common congenital heart disease
• describe the management options for cyanotic and non-cyanotic congenital heart disease
• explain the role of endocarditis prophylaxis
• describe the natural history of common and rare congenital conditions with and without previous cardiac surgery
• discuss the physical and psychological problems that may arise in adults with congenital heart disease.
	• elicit and document a detailed family and clinical history to develop a pedigree for disease
	• perform a specific systemic physical examination, including the detection of non-cardiac features
	• interpret the results of genetic tests
	• assess common congenital heart conditions using echocardiography
	• perform an ECG and interpret the results
	• liaise with specialists in congenital heart disease and paediatric cardiologists
	• manage adolescents and adults with complex congenital heart disease.

Teaching and Learning Opportunities

- In-patient consultations
- Private rooms
- Multidisciplinary meetings
- Ambulatory care
- Adult congenital heart disease clinic

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.4	**Conditions Affecting the Circulation**
Learning Objective 2.4.1	Assess and treat patients with hypertension

Knowledge	Skills
• describe the causes of hypertension. • describe the role of non-pharmacological treatments • describe the pharmacology of drugs currently used in the treatment of hypertension • discuss management options for a patient with resistant hypertension • explain protocols and management plans for hypertension.	• assess a patient with hypertension for end organ damage • investigate a patient for secondary hypertension • interpret appropriate biochemical investigations and imaging modalities • interpret ambulatory blood pressure recordings • manage patients with hypertensive emergencies.

Teaching and Learning Opportunities
• In-patient consultations • Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.4	**Conditions Affecting the Circulation**
Learning Objective 2.4.2	Assess and treat patients with pulmonary hypertension

Knowledge	Skills
• describe the following features of pulmonary hypertension, including primary and secondary pulmonary hypertension: ▪ causes ▪ epidemiology ▪ natural history ▪ symptoms and signs ▪ current acute and chronic medical management ▪ explain the role of heart-lung transplantation • describe indications for pulmonary angiography and referral for consideration of pulmonary endarterectomy.	• perform and interpret: ▪ haemodynamic measurements ▪ right heart catheterisation • select drug therapy and interventions for patients with pulmonary hypertension.

Teaching and Learning Opportunities
• In-patient consultations • Ambulatory care • Cardiac catheter laboratory • Coronary care unit

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.4	**Conditions Affecting the Circulation**
Learning Objective 2.4.3	Assess and treat patients with acute and chronic thromboembolic disease

Knowledge	Skills
• describe the pathophysiology and epidemiology of pro-coagulant disorders • describe causes and predisposing factors for thromboembolic disease • describe the risk profile of a patient for thromboembolic disease • explain the consequences of thromboembolic disease, including pulmonary embolism • explain the medical management of thromboembolic disease • discuss the management of recurrent thromboembolic disease • explain the condition of chronic thromboembolic pulmonary hypertension.	• select and interpret appropriate investigations including: ▪ duplex scans ▪ lung ventilation/perfusion (VQ) scans ▪ CT pulmonary angiography ▪ ECG ▪ cardiac MR • develop a management plan for a patient with acute thromboembolic disease • develop a management plan for a patient with chronic thromboembolic disease • perform and interpret: ▪ haemodynamic measurements ▪ right heart catheterisation • manage a haemodynamically compromised patient with pulmonary embolism.

Teaching and Learning Opportunities

- Emergency department
- in-patient consultations
- Ambulatory care
- Cardiac catheter laboratory

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.4	**Conditions Affecting the Circulation**
Learning Objective 2.4.4	Assess and treat patients with diseases of the aorta

Knowledge	Skills
• describe the pathogenesis, presentation and natural history of aortic aneurysms including aortic dissection • explain familial disease of the aorta, including common genetic mutations • describe bicuspid aortic valve and associated aortic diseases • describe the natural history of corrected and uncorrected coarctation • explain medical therapy options for diseases of the aorta • define the indications and limitations of anti-hypertensive drugs • describe the indications for percutaneous and surgical intervention, including open repair and stent procedures • discuss the need for, and approaches to, long term follow-up of patients with aortic disease.	• select and interpret appropriate non-invasive imaging, including: ▪ echocardiography ▪ CT ▪ MRI • assess, manage and give advice on patients with acute aortic dissection.

Teaching and Learning Opportunities
• Emergency department • In-patient consultations • Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.4	**Conditions Affecting the Circulation**
Learning Objective 2.4.5	Assess and treat patients with systemic vascular disease

Knowledge	Skills

• describe the pathophysiology of arterial and venous disease
• describe the clinical presentation of aortic aneurysm and dissection
• describe the natural history and clinical presentations of:
  ▪ cerebrovascular disease
  ▪ renovascular disease
  ▪ peripheral vascular disease
• identify clinical manifestations of acute and chronic venous disease
• explain management techniques for vascular disease, including stenting
• describe heritable acquired connective tissue diseases, including their potential effects on the heart and circulation (e.g. systemic lupus erythematosus).
	• conduct an examination of peripheral vasculature
	• examine the musculoskeletal system to detect connective tissue disorders
	• assess and manage vascular trauma, and identify when to refer to a vascular surgeon
	• interpret the results of:
	  ▪ Doppler ultrasound imaging and flow studies
	  ▪ peripheral angiography investigations
	  ▪ CT and MR angiograms.

Teaching and Learning Opportunities

- In-patient consultations
- Ambulatory care
- Observation of vascular surgery procedures and stenting

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.4	**Conditions Affecting the Circulation**
Learning Objective 2.4.6	Assess and treat patients with lipid abnormalities

Knowledge	Skills
• recognise normal and abnormal lipid biochemistry • describe the epidemiology and pathophysiology of lipid disorders • describe the common genetic abnormalities affecting lipid metabolism • explain methods to investigate and manage patients with lipid disorders • describe the pharmacology of drugs currently used in the treatment of lipid disorders • discuss current evidence for pharmacological intervention in both primary and secondary prevention.	• interpret lipid test results • select and prescribe lipid lowering medications • explain the management of lipid disorders to patients • explain basic principles of a healthy lifestyle and diet to patients.

Teaching and Learning Opportunities

- In-patient consultations
- specialist lipid clinic
- Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.5	**At-Risk Individuals and Groups**
Learning Objective 2.5.1	Identify and discuss the prevalence of cardiovascular disease in Aboriginal and Torres Strait Islander and Maori and Pacific Islander populations
Learning Objective 2.5.2	Manage acute and chronic cardiovascular disease in Aboriginal and Torres Strait Islander and Maori and Pacific Islander populations

Knowledge	Skills
• identify and discuss the incidence of cardiovascular disease in these populations • explain the risk factors for cardiovascular disease in these populations • discuss the importance of cultural awareness and culturally sensitive management of cardiovascular disease in these populations.	• participate in the care of Aboriginal and Torres Strait Islander and Maori and Pacific Islander patients with cardiovascular disease • participate in cardiovascular outreach clinics.

Teaching and Learning Opportunities

- Teaching hospital, community centres, regional communities
- Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.5	At Risk Individuals and Groups
Learning Objective 2.5.3	Assess and treat heart disease in patients who are pregnant or planning pregnancy

Knowledge	Skills
• describe the physiological changes during pregnancy and the post-partum period and their impact on cardiovascular disease • describe the implications of anticoagulation during pregnancy • explain the implications and risks of cardiac disorders on pregnancy • explain the implications and risks of pregnancy on cardiac disorders • describe the issues involved in valvular surgery • explain the risks for the foetus of congenital heart disease in mothers • discuss principles of medical and interventional management of mothers with heart disease • discuss prescribing problems encountered during pregnancy • describe appropriate investigations for a pregnant woman with cardiac disease.	• assess a cardiac patient's risk of becoming pregnant • provide pre-pregnancy counselling and refer for contraceptive advice • manage patients with hypertension and heart disease throughout pregnancy, delivery and the post-natal period • explain the importance of a multidisciplinary approach in treating patients with cardiac disease during the anti-partum, delivery and post-partum periods.

Teaching and Learning Opportunities
• In-patient consultations • Specialty clinic • Multidisciplinary meetings • Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.5	**At Risk Individuals and Groups**
Learning Objective 2.5.4	Assess and manage heart disease in elderly patients
Learning Objective 2.5.5	Assess and manage heart disease in patients with co-morbidity

Knowledge	Skills
• describe the epidemiology of heart disease in elderly people • identify the clinical presentations of heart disease in elderly people • explain the interaction of heart disease with multi-system diseases, including renal impairment • describe the considerations required in drug treatment for elderly people • describe the indications for cardiac surgery in elderly people.	• conduct an appropriate examination in an elderly person, factoring in limited mobility • discuss management strategies with the patient, family members and carers • lead and contribute to a multidisciplinary health care team.

Teaching and Learning Opportunities

- In-patient consultations
- Ambulatory care
- Emergency department assessments

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.5	**At Risk Individuals and Groups**
Learning Objective 2.56	Assess and treat patients with risk factors for atherosclerotic vascular disease

Knowledge	Skills

• describe the epidemiology of ischaemic heart disease
• describe the investigation and management options for patients with:
  ▪ systemic hypertension (both primary and secondary)
  ▪ lipid disorders
  ▪ diabetes
  ▪ history of smoking
  ▪ family history of cardiovascular disease
• describe the impact of "metabolic syndrome" upon vascular health
• calculate a patient's absolute risk of cardiovascular disease on the basis of standard risk factors.
	• assess the prevalence of coronary heart disease in the community
	• manage risk factors for individual patients
	• explain basic principles of a healthy lifestyle and diet to patients.

Teaching and Learning Opportunities

- Cardiac ward
- In-patient consultations
- Ambulatory care

DOMAIN 2	DISEASES AND PRESENTATIONS
Theme 2.5	**At Risk Individuals and Groups**
Learning Objective 2.5.7	Explain the risk of driving following a cardiac illness and advise patients on fitness to drive

Knowledge	Skills
• identify Australian and New Zealand 'Fitness to Drive' guidelines and local driver licensing requirements.	• assess and advise patients on their fitness to drive following cardiac illness.

Teaching and Learning Opportunities

- Inpatient consultations
- Ambulatory care

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.1	**Electrophysiology (EP) and Pacing**
Learning Objective 3.1.1	Describe the indications for electrophysiology study and explain the possible therapeutic options, including use of implantable cardioverter-defibrillators and ablative procedures
Learning Objective 3.1.2	Explain the principles of cardiac pacing and application of pacing to patient management
Learning Objective 3.1.3	Describe diagnostic and therapeutic electrophysiology

Knowledge	Skills
• describe the normal and abnormal electrophysiology of the heart, including fundamental cellular electrophysiology • describe electrophysiology and cardiac anatomy relevant to pacing • explain the pharmacology of drugs affecting cardiac electrophysiology • describe the indications for and complications of cardiac electrophysiology studies, including ablation procedures • explain the principles of action of cardiac pacemakers, including biventricular pacemakers and implantable cardioverter-defibrillators (ICDs) • describe the indications for and complications of implantation of temporary and permanent cardiac pacemakers and ICDs • describe the electrophysiological complications of pacemakers and common forms of pacemaker dysfunction • describe the principles of pacemaker interrogation and programming • discuss the importance of radiation protection • recognise properties of different pacing systems used.	• safely obtain central venous access and place temporary transvenous pacing wire in right ventricle • participate in decision making concerning referral for electrophysiology and ablation procedures • observe the performance of electrophysiology and ablation procedures • participate in the testing and follow-up of ICD implants • insert temporary pacing systems • observe and participate in the implantation of permanent pacemakers • monitor, interrogate and programme pacemakers • recognise and manage complications of a pacing system.

Teaching and Learning Opportunities

- In-patient consultations
- Operating theatre
- Pacing clinic
- Ambulatory care
- Cardiac catheter laboratory

Minimum Practical Performance requirements

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.1	**Electrophysiology (EP) and Pacing**
Learning Objective 3.1.1	Describe the indications for electrophysiology study and explain the possible therapeutic options, including use of implantable cardioverter-defibrillators and ablative procedures
Learning Objective 3.1.2	Explain the principles of cardiac pacing and application of pacing to patient management
Learning Objective 3.1.3	Describe diagnostic and therapeutic electrophysiology

Pacemakers

- Perform temporary transvenous pacemaker insertion — 10 cases
- Participate in or observe permanent pacemaker implantation — 10 cases
- Participate in testing permanent pacemaker function in follow up clinics — 100 cases*

**50 of which should be dual chamber pacemakers*

Electrophysiology

- Participate in the decision making concerning referral for EP studies — 20 cases
- Participate in the performance of the study, interpretation of reports and post-procedure management
- Participate in the decision making concerning referral for EP study and catheter ablation — 10 cases**
- Participate in ablation techniques, interpretation of reports and post-procedure management

***may be included as part of 20 EP studies)*

Implantable Cardioverter-Defibrillators (ICDs) — 3 cases

- Participate in decision making concerning referral for ICD
- Participate in or observe the procedure
- Participate in the post-procedure management

Cardiac resynchronisation therapy — 3 cases

- Participate in decision making, assessment and management of patients undergoing cardiac resynchronisation therapy

Documentation: Should include cases presented and observed and a supervisor's report indicating satisfactory attendance during EP attachment signed by the supervising EP consultant.

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.2	**Pericardiocentesis**
Learning Objective 3.2.1	Perform pericardiocentesis in the diagnosis and treatment of patients with pericardial disease

Knowledge	Skills
• describe normal and abnormal pericardial anatomy and surface relations • describe the common causes of pericardial effusions • define the indications for diagnostic and therapeutic pericardiocentesis • define the role of image guidance for pericardiocentesis • define the role of percutaneous vs. surgical drainage.	• identify when pericardiocentesis is indicated • explain the risks and benefits of pericardiocentesis to patients and family members • perform pericardiocentesis • safely place and remove a pericardial drain • manage cardiac tamponade • obtain informed consent • arrange for investigations to be performed on the pericardial aspirate.

Minimum Practical Performance requirements	
• Pericardial aspiration under supervision	6 cases

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.3	**Electrocardiography and Holter Monitoring**
Learning Objective 3.3.1	Perform and interpret electrocardiography and Holter monitoring procedures

Knowledge	Skills
• describe the indications and reporting methods for the following investigations: ▪ electrocardiograms (including high resolution) ▪ ambulatory ECG ▪ loop event recordings ▪ ST segment monitoring.	• explain correct electrode placement for rest and exercise ECGs and ambulatory ECGs • supervise, analyse and monitor ECG recordings • interpret and communicate results to referring physicians.

Minimum Practical Performance requirements	
• Report Holter monitors under supervision	100 cases

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.4	**Exercise Testing**
Learning Objective 3.4.1	Supervise and interpret exercise testing

Knowledge	Skills
• describe the indications the indications and reporting methods for exercise testing • describe the physiology of exercise, including cardiovascular and respiratory physiology • explain the role of pre-test probability and Bayes Theorem and how this influences interpretation of exercise tests • identify causes of false positive and false negative exercise electrocardiograms • explain the significance of haemodynamic responses during exercise • discuss the effect of drug therapy upon exercise testing.	• supervise and analyse exercise ECG tests • interpret the results of exercise tests • perform cardiopulmonary resuscitation.

Minimum Practical Performance requirements	
• Supervise and report exercise ECG tests	100 cases

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.5	**Cardioversion**
Learning Objective 3.5.1	Perform chemical and direct current cardioversion

Knowledge	Skills
• describe indications for cardioversion • identify the requirements for anticoagulation.	• perform cardioversion safely.

Minimum Practical Performance requirements	
• Perform direct current cardioversion	10 cases

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.6	**Cardiac Catheterisation and Angiography**
Learning Objective 3.6.1	Perform and interpret cardiac catheterisation and angiography

Knowledge	Skills
• recognise normal and abnormal coronary anatomy • recognise normal and abnormal peripheral vascular anatomy • recognise common congenital abnormalities of the heart • describe pericardial anatomy and disease states • describe the indications for cardiac catheterisation and coronary angiography • recognise normal and abnormal haemodynamics of right and left heart • describe the pharmacology of drugs and agents used in cardiac catheter laboratory • explain the complications and adverse events, including relative risks • discuss patient safety procedures • explain the principles of radiography and radiation safety • describe radiographic projections and image analysis • explain stent types, selection and implantation • describe indications, procedures and limitations of percutaneous interventions • identify various techniques and their complications.	• assess patients before the procedure • obtain safe arterial and venous vascular access • perform catheterisation and pressure measurement of cardiac chambers and pulmonary vasculature • perform safe catheterisation and angiography of right and left coronary arteries • manipulate radiographic imaging planes to obtain multiple diagnostic images • remove catheters and secure effective haemostasis • manage common complications arising during and after catheterisation and angiography • interpret the results of angiography and manage patients including referral for PCI or cardiac surgery • observe and assist with percutaneous coronary interventions • identify and apply the technique of trans-septal puncture and myocardial biopsy.

Minimum Practical Performance requirements

Right heart catheter 25 cases

- Perform and report right heart catheterisation and haemodynamics

Left heart catheter and coronary angiography 150 cases*

- Perform and report left heart catheterisation and coronary angiography

**of which 75 should be as primary operator*

Intra-aortic balloon pump 3 cases

- Insert intra-aortic balloon pumps under supervision

Documentation: The trainee must maintain a logbook of procedures undertaken, which must include the nature of the procedure, diagnosis and findings, any complications of the procedure and the role of the trainee. The trainee must review the logbook with his/her supervisor at least quarterly each year.

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.7	**Coronary Angioplasty**
Learning Objective 3.7.1	Select and manage patients for percutaneous coronary intervention and related techniques

Knowledge	Skills
• describe the indications for percutaneous coronary intervention • discuss current coronary intervention technologies.	• select patients for referral • manage a patient pre-procedure • manage a patient post-procedure.

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.8	**Echocardiography**
Learning Objective 3.8.1	Perform and interpret echocardiography

Knowledge	Skills
• recognise normal and abnormal cardiac anatomy including common congenital lesions, physiology, haemodynamics and their abnormalities relevant to echocardiography • describe the indications, techniques, limitations and complications of echocardiographic modalities including: ▪ transthoracic echocardiography ▪ transoesophageal echocardiography ▪ stress echocardiography • describe the practical and technical aspects and complications of these tests • describe the indications, techniques, limitations and complications of other non-invasive cardiac imaging modalities including: ▪ nuclear cardiology ▪ cardiac MR ▪ cardiac CT • explain physical principles behind ultrasound image formation, Doppler imaging and flow velocity measurement • identify factors influencing image quality and	• safely perform and interpret: ▪ unsupervised transthoracic examinations ▪ supervised transoesophageal echocardiographic examinations • apply the following modalities: ▪ 2D imaging ▪ pulsed wave Doppler ▪ continuous wave Doppler ▪ colour flow imaging ▪ M-mode • produce an echocardiography report • discuss the echocardiographic findings with sonographers, patients and consultants • select and use appropriate probe, machine and image settings to obtain and optimise image quality • recognise the presence of artefacts and how to differentiate from true pathology • perform and interpret agitated saline contrast echocardiography to assess intra-cardiac shunts

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.8	**Echocardiography**
Learning Objective 3.8.1	Perform and interpret echocardiography

artefacts • interpret the standard and the additional echo windows and image planes for comprehensive transthoracic and transoesophageal echocardiography • describe conventional models of left ventricular segmentation • explain the development of a quality assurance program for an echo lab.	and right ventricular function • observe or participate in: ▪ transoesophageal echocardiography ▪ exercise stress echocardiography ▪ pharmacologic stress echocardiography • observe 3-D and contrast echocardiography (left ventricular opacification and where possible myocardial contrast echo).

Minimum Practical Performance requirements

• Report echocardiograms under supervision	600 cases*
	** at least 50 should be transoesophageal*
• Perform and report transthoracic echocardiograms	300 cases**
• Observe or participate in transoesophageal echo cases	50 cases**
• Observe or participate in stress echo cases	25 cases**
	** *may be included in the 600 echocardiograms reported under supervision*

Documentation: Trainees should maintain a logbook of all the above echocardiography examinations, including the clinical indication for the test, the nature of the examination, role of the trainee, diagnosis and findings and any complications. The logbook should be reviewed with the supervisor quarterly during each year of core training.

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.9	**Cardiac Surgery**
Learning Objective 3.9.1	Describe the indications for cardiac surgery and manage patients before and after surgery

Knowledge	Skills
• describe the nature of cardiac surgery, the management of patients before, during and after cardiac surgery • explain the principles of patient management in cardiac surgery • explain the indications for surgery • discuss the collaboration between cardiologists and cardiac surgeons required to effectively manage patients	• refer patients to cardiac surgeons for coronary or valvular heart disease • evaluate the risks and likely benefits of cardiac surgery for individual patients and explain these to patients • prepare patients for cardiac surgery, including evaluation of co-morbidities and pre-operative cardiac investigations • assess the patient, and their imaging studies,

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.9	**Cardiac Surgery**
Learning Objective 3.9.1	Describe the indications for cardiac surgery and manage patients before and after surgery

- explain the theoretical basis underpinning major types of cardiac surgery for valvular and coronary heart disease and their selection in individual patients.
- Describe post-operative surgical care including:
  - the management of ventilated patients
  - management of hemodynamic instability
  - arrhythmia management
  - post-operative emergencies.

pre-operatively

- participate in immediate and long-term post-operative management of patients.

Minimum Practical Performance requirements

• Complete an attachment to a Cardiothoracic Surgical Unit (CTSU)	10 days
• Coronary Artery Bypass Grafting	3 cases
in sites where off-pump operations are performed, an off-pump case should be included in the three cases	
• Valve Surgery	2 cases
one aortic valve and one mitral valve	
• Brief Case Presentations	2 case presentations
two of the above cases should be discussed as brief presentations to a working meeting of the CTSU in the presence of the supervising surgeons	10 minutes duration each
• ICU/CICU ward rounds	10 ward rounds
participation in the daily ward rounds for the duration of the attachment.	
• Unit Meetings	
attend and participate in multidisciplinary meetings within the CTSU.	

Documentation required includes:

- details of the patients assessed
- their pre-operative assessment
- investigations
- observed surgery
- immediate post-operative care:
- the cases presented
- statement of satisfactory attendance during the CTS attachment signed by the supervising surgeon.

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.10	**Radiation and Cross Sectional Imaging**
Learning Objective 3.10.1	Use radiation equipment in the diagnosis, assessment and treatment of patients with cardiac disease

Knowledge	Skills
• explain the physics and hazards of ionising radiation to patients and staff • identify current statutory requirements concerning the medical use of ionising radiation • describe the operation of the equipment involved in the use of ionising radiation • identify factors that affect radiation exposure to both patients and staff • describe the physics of commonly used medical radioisotopes including nuclear cardiology • explain the principles and practical implementation of protective measures to limit exposure to ionising radiation for patients and staff • discuss important aspects of cardiac radiology.	• measure radiation exposure • utilise radiation equipment safely and effectively.

Teaching and Learning Opportunities

- Cardiac catheter suite
- Radiology laboratory
- Nuclear medicine laboratory

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.10	**Radiation and Cross Sectional Imaging**
Learning Objective 3.10.2	Define the indications for nuclear cardiology and interpret the results of common cardiac nuclear medicine investigations

Knowledge	Skills
• describe the radionuclides and radiopharmaceuticals used in nuclear cardiology • describe the physics of commonly used medical radioisotopes • describe the principles of operation of the gamma camera and methods of computerised image acquisition and processing • describe the indicators for undertaking radionuclide imagery for investigating the heart at rest and with exercise • identify different types of stress testing • discuss the importance of radiation protection • describe the equipment used for nuclear cardiology imaging.	• interpret results of nuclear investigations • identify important sources of error and artifact in image interpretation • synthesise image findings with other clinical information for the patient.

Teaching and Learning Opportunities
• Nuclear medicine laboratory

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.10	**Radiation and Cross Sectional Imaging**
Learning Objective 3.10.3	Explain the applications and limitations of cardiac computed tomography (CT) and magnetic resonance (MR) imaging

Knowledge	Skills
• identify principles of cardiac CT and MR imaging • recognise normal CT and MR imaging findings of the heart • recognise major abnormal CT and MR imaging findings of the heart • describe the limitations of imaging technology including spatial and temporal resolution • describe the indications and contra-indications for the use of CT and MR imaging • recognise the role and limitations of CT coronary imaging • discuss the importance of radiation protection.	• review and discuss cardiac CT and MR images • identify important sources of error in image interpretation • synthesise image findings with other clinical information for the patient • explain the application and limitation of cardiac CT and MR imaging to patients and their families.

Teaching and Learning Opportunities

- Radiology department and imaging services
- Multidisciplinary meetings

DOMAIN 3	PRACTICAL PERFORMANCE, PROCEDURES AND INVESTIGATIONS
Theme 3.11	**Ambulatory Care**
Learning Objective 3.11.1	Assess and manage patients in the ambulatory care (outpatient) setting

Knowledge	Skills
• identify and describe the clinical features of all cardiovascular diseases • explain the clinical indications for cardiovascular pharmacological treatment • recognise the indications, roles and pathways of non-invasive and invasive cardiovascular investigation.	• assess and manage patients presenting with a spectrum of symptoms and clinical presentations • formulate a diagnostic pathway which is clinically and cost efficient • identify the pharmacological treatment of cardiovascular diseases, particularly with multiple drugs • explain the implications of illness and its implications to patients and their family members.

Minimum Practical Performance requirements

- Manage patients in an ambulatory care (outpatient) setting under supervision — 300 patients*

**of which 150 are new patients*

MINIMUM PRACTICAL PERFORMANCE REQUIREMENTS

The trainee must maintain a logbook of procedures undertaken, which must include the nature of the procedure, diagnosis and findings, any complications of the procedure and the role of the trainee.

In addition, the logbook of echocardiography examinations must include the clinical indication for the test, the nature of the examination, role of the trainee, diagnosis and findings and any complications.

The trainee must review the logbook with his/her supervisor each year.

The minimum practical performance requirements are as follows:

Procedures	Minimum number
Pacemakers	
• Perform temporary transvenous pacemaker insertion	10 cases
• Participate in or observe permanent pacemaker implantation	10 cases
• Participate in testing permanent pacemaker function in follow up clinics	100 cases*
**50 of which should be dual chamber pacemakers*	
Electrophysiology	
• Participate in the decision making concerning referral for EP studies	20 cases
• Participate in the performance of the study, interpretation of reports and post-procedure management	
• Participate in the decision making concerning referral for EP study and catheter ablation	10 cases**
• Participate in ablation techniques, interpretation of reports and post-procedure management	
***may be included as part of 20 EP studies*	
Implantable Cardioverter-Defibrillators (ICDs)	3 cases
• Participate in decision making concerning referral for ICD	
• Participate in or observe the procedure	
• Participate in the post-procedure management	
Cardiac resynchronisation therapy	3 cases
• Participate in decision making, assessment and management of patients undergoing cardiac resynchronisation therapy	
Pericardial aspiration	6 cases
• Pericardial aspiration under supervision	
Holter monitors	100 cases
• Report Holter monitors under supervision	
Electrocardiography	100 cases

Procedures	Minimum number
• Supervise and report exercise ECG tests	
Direct current cardioversion	10 cases
• Perform direct current cardioversion	
Right heart catheter	25 cases
• Perform and report right heart catheterisation and haemodynamics	
Left heart catheter and coronary angiography	150 cases*
• Perform and report left heart catheterisation and coronary angiography	
**of which 75 should be as primary operator*	
Intra-aortic balloon pump	3 cases
• Insert intra-aortic balloon pumps under supervision	
Echocardiography	600 cases*
• Report echocardiograms under supervision	
** at least 50 should be transoesophageal*	
• Perform and report transthoracic echocardiograms	300 cases**
• Observe or participate in transoesophageal echo cases	50 cases**
• Observe or participate in stress echo cases	25 cases**
** *may be included in the 600 echocardiograms reported under supervision*	
Cardiothoracic surgical rotation	10 days
• Complete an attachment to a Cardiothoracic Surgical Unit (CTSU)	
• Coronary Artery Bypass Grafting	3 cases
in sites where off-pump operations are performed, an off-pump case should be included in the three cases	
• Valve Surgery	2 cases
one aortic valve and one mitral valve	
• Brief Case Presentations	2 case presentations
two of the above cases should be discussed as brief presentations to a working meeting of the CTSU in the presence of the supervising surgeons	10 minutes duration each
• ICU/CICU ward rounds	10 ward rounds
participation in the daily ward rounds for the duration of the attachment.	
• Unit Meetings: *attend and participate in multidisciplinary meetings within the CTSU.*	
Ambulatory care	300 patients*
• Manage patients in an ambulatory care (outpatient) setting under supervision	
**of which 150 are new patients*	

Specific documentation required in logbooks
Electrophysiology documentation: Should include cases presented and observed and a supervisor's report indicating satisfactory attendance during EP attachment signed by the supervising EP consultant.
Catheter and coronary angiography documentation: The trainee must maintain a logbook of procedures undertaken, which must include the nature of the procedure, diagnosis and findings, any complications of the procedure and the role of the trainee. The trainee must review the logbook with his/her supervisor at least quarterly each year.
Echocardiogram documentation: Trainees should maintain a logbook of all the above echocardiography examinations, including the clinical indication for the test, the nature of the examination, role of the trainee, diagnosis and findings and any complications. The logbook should be reviewed with the supervisor quarterly during each year of core training.
Cardiothoracic surgical rotation documentation: • details of the patients assessed • their pre-operative assessment • investigations • observed surgery • immediate post-operative care • the cases presented • statement of satisfactory attendance during the CTS attachment signed by the supervising surgeon.

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