Appendix 2: Cardiothoracic Surgery Syllabus

The syllabus contains the specialty topics that must be covered in the training programme Each of these topics includes one or more learning objectives. Formative WBAs may be used to assess and provide feedback on any areas of clinical activity. However, other than for the critical conditions, index procedures or where they have been identified to address a concern, WBAs are optional and trainees, therefore, do not need to use WBAs to evidence their learning against each syllabus topic.

In the three phases of specialty training the following methodology is used to define the level of performance/competence to be achieved at completion of each phase in the domains of:

- specialty-based knowledge
- clinical skills and judgement
- technical and operative skills

Standards for knowledge

The standard of knowledge which is assessed by the ISB is set at the level of a day-one consultant in the generality of the specialty.

Some topics for a level or phase of training also have a competence level ascribed to them for knowledge ranging from 1 to 4 which indicates the depth of knowledge required:

1. knows of
2. knows basic concepts
3. knows generally
4. knows specifically and broadly

Standards for clinical and technical skills

The practical application of knowledge is evidenced through clinical and technical skills. Each topic has a competence level ascribed to it in the areas of clinical and technical skills ranging from 1 to 4:

1. Has observed

Exit descriptor; at this level the trainee:

- has adequate knowledge of the steps through direct observation
- can handle instruments relevant to the procedure appropriately and safely
- can perform some parts of the procedure with reasonable fluency.

2. Can do with assistance

Exit descriptor; at this level the trainee:

- knows all the steps - and the reasons that lie behind the methodology
- can carry out a straightforward procedure fluently from start to finish under direct supervision

- knows and demonstrates when to call for assistance/advice from the supervisor (knows personal limitations).

3. Can do whole but may need assistance
Exit descriptor; at this level the trainee:

- can adapt to well-known variations in the procedure encountered, without direct input from the trainer
- recognises and makes a correct assessment of common problems that are encountered
- is able to deal with most of the common problems
- knows when help is needed
- requires advice rather than help that requires the trainer to scrub.

4. Competent to do without assistance, including complications

Exit descriptor, at this level the trainee:

- with regard to the common clinical situations in the specialty, can deal with straightforward and difficult cases to a satisfactory level and without the requirement for external input
- is at the level at which one would expect a day-one UK consultant surgeon to function
- is capable of supervising trainees.

Syllabus

Cardiac Surgery

	Phase 1	Phase 2 Card	Phase 3 Card	Phase 2 Thor	Phase 3 Thor	Critical Condition	Index Proc
Cardiopulmonary Bypass							
OBJECTIVE							
To manage with supervision the clinical and technical aspects of cardiopulmonary bypass (CPB)							
KNOWLEDGE							
Physiology of cardiopulmonary bypass							
Haemodynamics: physiology and measurement							
Haemostasis, thrombosis and bleeding							
Pharmacology and drugs used during cardiopulmonary bypass							

Inotropes, vasodilators and vasoconstrictors							
Haemostatic drugs							
Antiplatelet, anticoagulant and thrombolytic drugs							
Principles and practice of CPB							
Relevant equipment and technology and its application							
Monitoring during CPB							
Inflammatory and pathophysiological response to bypass							
Pulsatile and nonpulsatile flow							
Effect of CPB on pharmacokinetics							
Priming fluids and haemodilution							
Acid base balance - pH and alpha stat							
Neuropsychological consequences of CPB							
Cell salvage and blood conservation							
Minimal Access Incisions for coronary, aortic and mitral valve surgery	2	3	3	2	2		
CLINICAL SKILLS							
N/A							
TECHNICAL SKILLS AND PROCEDURES							
Median sternotomy open and close	3	4	4	4	4		
Minimal Access Incisions for coronary, aortic and mitral valve surgery	1	2	2	1	1		
Cannulation and institution of cardiopulmonary bypass	3	4	4	3	3		
Safe conduct of CPB - problem solving and troubleshooting	2	4	4	3	3		
Weaning from bypass and decannulation	3	4	4	3	3		

Femoral cannulation and decannulation	2	3	4	2	2		
Repeat sternotomy, with pericardial dissection, cardiac mobilisation and cannulation	1	3	4	1	1		

Myocardial Protection							
OBJECTIVE							
To manage with supervision the clinical and technical aspects of intraoperative myocardial protection.							
KNOWLEDGE							
Scientific foundations of myocardial preservation							
Principles and practice of myocardial preservation							
Cardioplegia solutions and delivery modes.							
Non-cardioplegic techniques of preservation							
CLINICAL SKILLS							
Myocardial management throughout the perioperative period							
Ability to adapt preservation technique to clinical situation							
TECHNICAL SKILLS AND PROCEDURES							
Relevant cannulation techniques and appropriate delivery of cardioplegia	2	3	4	2	2		
Circulatory Support							
OBJECTIVE							
To manage with supervision the clinical and technical aspects of circulatory support.							
KNOWLEDGE							

Inotropes, vasodilators and vasoconstrictors							
Mechanical circulatory support in the pre-operative, perioperative and post-operative periods							
Intra-aortic balloon pump - indications for use, patient selection and complications							
Physiology of the intra-aortic balloon pump							
Understanding of relevant equipment and technology (IABP / VAD etc)							
Ventricular assist devices, indications for use, patient selection and complications							
CLINICAL SKILLS							
Patient selection for mechanical circulatory support							
Management of the balloon pump including timing and troubleshooting							
Care of the patient with intra-aortic balloon pump, including recognition and management of complications							
TECHNICAL SKILLS AND PROCEDURES							
Insertion and positioning of an intra-aortic balloon pump	3	4	4	4	4		
Ischaemic Heart Disease							
OBJECTIVE							
To evaluate and manage with appropriate supervision the surgical aspects of a patient with ischaemic heart disease including the complications of ischaemic heart disease (IHD).							
KNOWLEDGE							

Anatomy of the heart and coronary arteries and anomalies of the coronary arteries							
Diagnosis investigation and assessment of IHD							
Risk stratification of patients undergoing coronary surgery							
Operative treatment - Off pump and on pump surgery							
Results of surgery, survival, graft patency, short and long term complications							
Choice of conduits for grafting							
Arterial revascularisation							
Redo coronary artery surgery							
Role of PCI and non-operative treatment in IHD							
Management of cardiovascular risk factors							
Acute complications of myocardial infarction and ischaemic heart disease							
Chronic complications of IHD - including VSD, mitral regurgitation, LV aneurysm.							
Cardiac rehabilitation following surgery for IHD							
Minimal Access Saphenous Vein Harvest	2	3	4	2	2		
Minimal Access Incisions for coronary surgery	2	3	3	2	2		
CLINICAL SKILLS							
Cardiovascular system - general history and examination, including conduit, drug history, identification of comorbidity and risk assessment							
Interpretation of Coronary Angiography (including invasive flow measures							

(FFR etc.) and Intravenous Ultrasound (IVUS)							
Interpretation of Cardiac Catheterisation data							
Interpretation of echocardiography (transthoracic and transesophageal) including 2D, Doppler, 3D and stress echo							
Interpretation of nuclear cardiology							
Management of post cardiac surgical patient							
Management of complications of coronary surgery	3	4	4	4	4	Yes	
TECHNICAL SKILLS AND PROCEDURES							
Saphenous vein harvest	4	4	4	4	4		
Internal mammary artery harvest	3	4	4	3	3		
Radial artery harvest	3	4	4	3	3		
Minimal Access Saphenous Vein Harvest	2	3	4	2	2		
Minimal Access Incisions for coronary surgery	1	2	2	1	1		
Proximal coronary anastomosis	3	4	4	3	3		
Distal coronary anastomosis	2	4	4	2	2		
Isolated, first time coronary surgery on pump	2	3	4	N/A	N/A		Index
Isolated, first time coronary artery surgery off pump (OPCAB)	1	3	3	N/A	N/A		
Minimally invasive surgical coronary artery surgery techniques (including MIDCAB)	1	1	2	N/A	N/A		
Redo coronary artery surgery	1	2	3	N/A	N/A		
Surgery for acute complications of ischaemic heart disease (including post infarction VSD, mitral regurgitation)	1	1	2	N/A	N/A		

Surgery for chronic complications of ischaemic heart disease (including ischaemic mitral regurgitation and left ventricular aneurysm)	1	1	2	N/A	N/A		
Heart Valve Disease							
OBJECTIVE							
To evaluate and manage, with appropriate supervision, a patient with both uncomplicated heart valve disease, including operative management.							
KNOWLEDGE							
Anatomy of the heart, chambers, valves and their anomalies							
Cardiovascular physiology, including valve physiology and haemodynamics							
Electrophysiology, including conduction disorders							
Pathophysiology of valve incompetence and stenosis.							
Consequences of valve disease on cardiac function and morphology							
Pathophysiology of mixed valve disease and combined valve pathology (e.g. aortic and mitral)							
Combined valvular and ischaemic heart disease							
Atrial fibrillation and other arrhythmias							
Endocarditis - native and prosthetic valve	3	4	4	4	4	Yes	
Diagnosis, investigation and assessment of valvular heart disease							
Timing of surgical intervention in valve disease							

Risk stratification of patients undergoing valve surgery							
Options for operative management, including: Valve replacement/repair (mechanical, biological stented and stentless grafts, homografts and autografts)							
Valve design: materials, configuration and biomechanics.							
Results of valve surgery – survival, valve thrombosis, endocarditis, bleeding.							
Surgery for disease of the conduction system							
Surgical treatment of arrhythmias							
CLINICAL SKILLS							
Cardiovascular system - general history and examination including drug history, identification of co-morbidity and risk assessment							
Interpretation of coronary angiography							
Interpretation of cardiac catheterisation data, including left and right heart data							
Interpretation of echocardiography (transthoracic and transesophageal) including 2D, Doppler, 3D and stress echo							
Non-operative management of endocarditis	2	4	4	4	4	Yes	
Management of the complications of valve surgery	3	4	4	4	4	Yes	
Anticoagulation management including complications.							

TECHNICAL SKILLS AND PROCEDURES							
Minimal Access Incisions for coronary, aortic and mitral valve surgery	1	2	2	1	1		
Isolated, uncomplicated aortic valve replacement (biological or mechanical)	2	3	4	2	2		Index
Isolated uncomplicated mitral valve replacement	1	2	3	2	2		Index
Tricuspid valve surgery	1	2	3	1	1		
Aortic valve and graft surgery	1	3	4	1	1		Index
Mitral valve and graft surgery	1	2	3	1	1		
Surgical strategies for managing the small aortic root	1	2	3	1	1		
Redo Valve surgery	1	2	3	1	1		
Valve surgery for endocarditis	1	2	3	1	1		
Techniques for surgical ablation of arrhythmias (+/- occlusion of the LA appendage)	2	3	4	1	1		
Mitral valve repair	1	2	3	1	1		
Isolated, uncomplicated aortic valve replacement (sutureless)	1	2	3	N/A	N/A		
Minimally invasive aortic valve replacement	1	2	2	N/A	N/A		
Minimally invasive mitral valve repair/replacement	1	1	2	N/A	N/A		
Transcatheter treatment of aortic valve disease (including non-transfemoral TAVI)	1	1	2	N/A	N/A		
Transcatheter treatment of structural heart valve disease (transfemoral TAVI, mitral valve etc.)	1	1	1	N/A	N/A		
Aorta Vascular Disease							
OBJECTIVE							
To evaluate and manage uncomplicated surgical aspects of a patient with aorta vascular disease, including operative management where appropriate and up to the defined competence. This module provides intermediate training in a complex sub-speciality.							

KNOWLEDGE							
Pathophysiology and of hypothermia including the effects upon haemoglobin, metabolic rate and pH with their management							
Anatomy of the heart, pericardium and great vessels and their anomalies							
Anatomy of the peripheral vascular system							
Blood supply of the spinal cord							
Pathology of aortic disease							
Natural history of aortic disease							
Diagnosis, investigation and assessment of aortic disease							
Knowledge of operative treatment, including spinal cord and cerebral preservation strategies.							
Acute Aortic Syndromes (including Type A & B aortic dissection, intramural haematoma and penetrating aortic ulcers)	3	4	4	4	4	Yes	
Traumatic aortic rupture							
Thoracoabdominal aneurysm							
Aortic dissection non A non B dissection management	2	**3**	**4**	**2**	**2**		
Frozen Elephant Trunk Procedure	2	**2**	**3**	**1**	**1**		
Debranching of head and neck vessels	1	**2**	**2**	**1**	**1**		
Results of major aorta vascular surgery – survival, complication rates							
Non-surgical management including the role of endovascular stenting							

Management of cardiovascular and non-cardiovascular risk factors							
CLINICAL SKILLS							
Cardiovascular system - general history and examination including assessment of pre-operative complications, drug history, identification of co-morbidity and risk assessment							
Interpretation of angiography and aortography							
Interpretation of echocardiography (transthoracic and transesophageal) including 2D, Doppler, 3D and stress echo							
Interpretation of CT scanning							
Interpretation of MRI scanning							
Management of post cardiac surgical patient after major aortic surgery							
Management of the complications of major aortic surgery							
TECHNICAL SKILLS AND PROCEDURES							
Preparation for and management of cardiopulmonary bypass, including alternative, non-bypass strategies for descending aortic surgery	1	**2**	**3**	**1**	**1**		
Organ protection strategies including: Hypothermic Circulatory Arrest (HCA), Retrograde Cerebral Perfusion (RCP) and Selective Antegrade Cerebral Perfusion (SACP)	1	**2**	**3**	**1**	**1**		
Axillary cannulation	1	**2**	**3**	**1**	**1**		
Surgery for acute dissection of the ascending aorta	1	**2**	**3**	**1**	**1**		
Aortic root replacement	1	**2**	**3**	**1**	**1**		
Complex aortic surgery including arch surgery,	1	**1**	**2**	**1**	**1**		

descending aortic and thoracoabdominal aortic surgery							
Replacement of the Ascending Aorta (Interposition graft) +/- AVR	1	**2**	**3**	**1**	**1**		
Valve-sparing aortic root replacement	1	1	2	**1**	**1**		
Miscellaneous Cardiac Conditions							
OBJECTIVE							
To manage with supervision the clinical and technical aspects of various cardiothoracic conditions not included elsewhere in curriculum							
KNOWLEDGE							
Pathophysiology, diagnosis and management of primary and secondary cardiac tumours							
Pathophysiology, diagnosis and management of acute pulmonary embolus							
Pathophysiology, diagnosis and management of chronic thromboembolic pulmonary disease							
Alternatives to endocardial pacing and the complications of conventional pacing/rhythm management devices							
Pathophysiology, diagnosis and management of hypertrophic obstructive cardiomyopathy							
Pathophysiology of Atrial Fibrillation	2	**3**	**4**	**2**	**2**		
CLINICAL SKILLS							
Management of patients with cardiac tumours							

Management of patients with acute pulmonary embolus							
Management of patients with complications of conventional endocardial pacing							
Management of patients with hypertrophic obstructive cardiomyopathy							
TECHNICAL SKILLS AND PROCEDURES							
Surgery for removal of cardiac tumour (including atrial myxoma)	1	2	3	1	1		
Pulmonary embolectomy	1	1	2	1	1		
Insertion of permanent epicardial pacing lead	1	2	3	1	1		
Removal of infected pacing system	1	1	2	1	1		
Surgery for hypertrophic obstructive cardiomyopathies (including myomectomy)	1	1	2	1	1		
Standalone surgical options for management of Atrial Fibrillation	1	2	2	1	1		

Thoracic Surgery

	Phase 1	Phase 2 Card	Phase 3 Card	Phase 2 Thor	Phase 3 Thor	Critical Condition	Index Proc
General Management of a Patient Undergoing Thoracic Surgery							
OBJECTIVE							
To be competent in the evaluation and management of a patient undergoing Thoracic surgery including operative management, with appropriate supervision. The knowledge and clinical skills are common to all Thoracic surgical conditions, and should be read in conjunction with the curriculum for specific surgical conditions.							
KNOWLEDGE							
BASIC KNOWLEDGE							
Physiology							
Pulmonary physiology, ventilation and gas exchange							
Haemostasis, thrombosis and bleeding							
Acid base balance							

Metabolic response to trauma							
Digestive, renal and hepatic physiology							
Nutrition							
Anatomy							
Tracheobronchial tree and lungs							
Thoracic inlet, neck and mediastinum							
Oesophagus and upper GI tract							
Chest wall and diaphragm							
Pathology							
Inflammation and wound healing							
Bronchopulmonary infections							
ARDS							
Emphysema							
Pulmonary fibrosis							
Pulmonary manifestations of systemic disease							
Systemic manifestations of pulmonary disease							
Benign and malignant tumours of trachea, bronchus and lung parenchyma							
Pharmacology							
Bronchodilators							
H2 antagonists and proton pump inhibitors							
Haemostatic drugs							
Analgesics							
Antibiotics							
Anaesthetic agents, local and general							
Microbiology							
Organisms involved in respiratory infection including TB							
Organisms involved in wound infection							
Antibiotic usage and prophylaxis							
Antisepsis							

Management of intra pleural sepsis							
CLINICAL KNOWLEDGE							
Thoracic Incisions							
Types of incisions and appropriate use, including lateral, anterior, muscle sparing, video-assisted and robotic approaches.							
Sternotomy							
Difficult access and improving exposure.							
Early and late complications of thoracic incisions							
Analgesia including pharmacology, effectiveness, side effects and use in combination regimens							
Post-operative analgesia, including epidural, PCAS and paravertebral catheter techniques.							
Bronchoscopy							
The role of rigid and flexible bronchoscopy in the investigation of airway and pulmonary disease.							
The anaesthetic, airway and ventilatory management during rigid and flexible bronchoscopy							
Mediastinal exploration							
Endoscopic, radiological and surgical approaches used to evaluate and diagnose mediastinal disease of benign, infective, primary and malignant aetiology.							
Equipment for mediastinal exploration							
Relevant imaging techniques, and influence on surgical approach.							
CLINICAL SKILLS							
HISTORY AND EXAMINATION							
System specific and general history and examination, including							

drug history, identification of comorbidity and functional status.							
DATA INTERPRETATION							
Routine haematology and biochemical investigations							
Chest radiograph and ECG							
CT, including contrast enhanced CT							
Interpretation of imaging of the mediastinum.							
MRI and PET							
Respiratory function tests							
Ventilation/perfusion scan							
Blood gases							
Oesophageal function tests and contrast studies							
PATIENT MANAGEMENT							
Cardiopulmonary resuscitation							
Risk assessment, stratification and management of thoracic operations							
Management of patients making an uncomplicated or complicated recovery from thoracic operations.	3	4	4	4	4	Yes	
Post-operative management of pain control, respiratory failure, sputum retention, haemodynamic instability and low urine output.	3	4	4	4	4	Yes	
Treatment of cardiac arrhythmias							
Pain control							
Wound infection and disruption							
Blood transfusion and blood products							
Physiotherapy and rehabilitation							
Palliative care							
TECHNICAL SKILLS AND PROCEDURES							
Tracheostomy							
Fibreoptic bronchoscopy							

Chest aspiration							
Chest drain insertion							
Chest drain management							
OPERATIVE MANAGEMENT							
Incisions							
Correct positioning of patient for Thoracic surgery							
Perform and repair thoracic incisions, including lateral, anterior, muscle sparing, VATS and robotic incisions.							
Difficult thoracic access and improving exposure							
Perform and close sternotomy incision							
OPERATIVE MANAGEMENT							
Bronchoscopy							
Diagnostic & therapeutic bronchoscopy including biopsy - rigid and flexible.							
Mediastinal Exploration							
Surgical evaluation of the mediastinum using cervical, anterior, VATS and robotic approaches.							
Neoplasms of the Lung							
OBJECTIVE							
To assess and manage a patient with a neoplasm of the lung, including operative management and with appropriate supervision. Appreciation of the multidisciplinary, multimodality approach to the management of the condition.							
KNOWLEDGE							
Benign and malignant tumours of trachea, bronchus and lung parenchyma							
Epidemiology, presentation, diagnosis, staging (pre-operative, intraoperative and pathological) and treatment of lung cancer and lung metastases.							
Neoadjuvant and adjuvant treatment of lung cancer							

Results of treating thoracic malignancy by surgery, medical or oncological techniques, including multimodality management.							
Survival, recurrence rates and relapse patterns after surgical treatment and the investigation and management of relapse.							
Knowledge of palliative care techniques.							
Treatment of post-operative complications of pulmonary resection such as empyema and bronchopleural fistula.							
Role of repeat surgery in recurrent and second primary malignancies of the lung.							
Medical and surgical options to deal with recurrent or problematic complications of pulmonary resection.							
CLINICAL SKILLS							
Clinical history and examination							
Interpretation of laboratory, physiological and imaging techniques.							
Interpretation of endoscopic findings.							
Patient selection with assessment of function and risk.							
TECHNICAL SKILLS AND PROCEDURES							
Bronchoscopic assessment including biopsy	3	3	3	4	4		
Endoscopic and surgical techniques of lung biopsy	2	2	2	4	4		
Mediastinal assessment and biopsy	2	2	2	4	4		
Intraoperative diagnosis and staging	2	2	2	3	4		

Endoscopic management of tumours using laser and stenting	1	1	1	2	4		
Surgery for benign and malignant conditions of the lungs	2	2	2	3	4		Index
Minimally invasive anatomical lung resection (VATS, Uniportal or Robotic)	1	1	1	3	4		Index
Segmentectomy and lobectomy for benign and malignant disease	2	2	2	3	4		
Redo operations for lung metastases	1	1	1	3	4		
Advanced resections for lung cancer, including sleeve lobectomy, pneumonectomy and extended resections involving chest wall and diaphragm.	1	1	1	2	3		
Management of post-operative complications such as empyema and bronchopleural fistula.	2	2	2	3	4		
Disorders of the Pleura							
OBJECTIVE							
To evaluate and manage surgical conditions of the pleura and the pleural space, including operative management and with appropriate supervision							
KNOWLEDGE							
Anatomy and physiology of the pleura							
Inflammatory, infective and malignant disease of the visceral and parietal pleura.							
Pneumothorax	3	4	4	4	4	Yes	
Pleural effusion							
Empyema							
Mesothelioma							
Haemothorax	3	4	4	4	4	Yes	
Chylothorax							

Conditions of adjacent organs that affect the pleura							
Medical and surgical management of pleural disease, including radiological, open and VATS techniques.							
Techniques to deal with failures of primary treatment.							
Advanced techniques for pleural space obliteration such as thoracoplasty and soft-tissue transfer							
CLINICAL SKILLS							
Interpretation of imaging of the pleura							
Chest drains: insertion, management, removal and treatment of complications.							
Management of patients making uncomplicated and complicated recovery from pleural interventions.							
TECHNICAL SKILLS AND PROCEDURES							
Open procedures for non-complex pleural problems	2	2	2	3	4		Index
VATS procedures for non-complex pleural problems	3	3	3	4	4		Index
Open and VATS procedures for empyema, including techniques for decortication.	2	2	2	3	4		Index
Open and VATS procedures in complex cases.	1	1	1	2	3		
Advanced techniques of pleural space obliteration.	1	1	1	2	3		
Disorders of the Chest Wall							
OBJECTIVE							
To assess and manage a patient with abnormality or disease affecting the chest wall,							

including surgical management where appropriate and with appropriate supervision							
KNOWLEDGE							
Anatomy of the chest wall							
Congenital, inflammatory, infective and neoplastic conditions that can affect the components of the chest wall.							
Clinical, laboratory and imaging techniques used in the evaluation of chest wall pathology.							
Techniques used in the diagnosis of chest wall disease, including aspiration and core biopsy, and incision and excision biopsy.							
Pectus deformities: aetiology, physiological and psychological consequences. Surgical options for correction.							
Techniques used to resect the sternum and chest wall, physiological and cosmetic sequelae.							
Prosthetic materials used in chest wall surgery							
The role of repeat surgery to deal with recurrent conditions and the complications of previous surgery.							
Techniques of complex chest wall reconstruction involving thoracoplasty or soft-tissue reconstruction							
CLINICAL SKILLS							
Clinical history and examination							
Interpretation of laboratory, physiological and imaging techniques.							
Patient selection with assessment of function and risk.							

TECHNICAL SKILLS AND PROCEDURES							
Chest wall biopsy and choice of appropriate technique.	3	3	3	4	4		
Open and excision biopsy and resection of the chest wall for benign and malignant conditions.	2	2	2	3	4		
Chest wall resection in combination with resection of the underlying lung.	1	1	1	2	3		
Selection and insertion of prosthetic materials, and selection of cases in which such materials are required	2	2	2	3	4		
Pectus correction, by both open and minimally-invasive techniques, including post-operative care and complications	1	1	1	2	3		
Surgery for the complications of chest wall resection, and repeat surgery to resect recurrent chest wall conditions.	1	1	1	2	3		
Complex chest wall reconstruction	1	1	1	2	3		
Disorders of the Diaphragm							
OBJECTIVE							
To assess and manage a patient with disease or abnormality of the diaphragm, including surgical management where appropriate, and with appropriate supervision.							
KNOWLEDGE							
Anatomy and physiology of the diaphragm.							
Pathology of the diaphragm.							
Clinical, physiological and imaging techniques in the assessment of							

diaphragmatic abnormalities.							
Physiological consequences of diaphragmatic herniation or paresis.							
Surgical techniques used to biopsy and resect diaphragmatic tumours.							
Situations in which replacement of the diaphragm is required, the materials used and their value and limitations.							
Complications of diaphragmatic resection and their management.							
Techniques used to electrically pace the diaphragm, and the conditions in which such treatment is appropriate.							
CLINICAL SKILLS							
Clinical history and examination							
Interpretation of laboratory, physiological and imaging techniques.							
Patient selection with assessment of function and risk.							
Management of patients making an uncomplicated or complicated recovery from diaphragmatic resection.							
TECHNICAL SKILLS AND PROCEDURES							
Resection and repair of the diaphragm and adjacent structures	1	1	1	3	4		
Complications of diaphragmatic resection	1	1	1	3	4		
Management of diaphragmatic trauma	2	2	2	3	4		
Emphysema and Bullae							
OBJECTIVE							

To fully assess and manage a patient with emphysema and bullae, including surgical management where appropriate, and with appropriate supervision.							
KNOWLEDGE							
Aetiology, pathology and physiology of chronic obstructive airways disease (COPD)							
Epidemiology and public health issues							
Smoking cessation measures.							
Clinical, laboratory, physiological and imaging techniques.							
Medical and surgical management of COPD and its complications							
Selection criteria and pre-operative preparation							
Surgical techniques used in the treatment of emphysema and bullae and the results of surgical treatment including relevant clinical trials.							
Lung volume reduction surgery: techniques, complications and management of complications.							
Endobronchial lung volume reduction							
Experimental and developmental techniques in lung volume reduction surgery							
CLINICAL SKILLS							
Clinical history and examination							
Interpretation of laboratory, physiological and imaging techniques.							
Patient selection with assessment of function and risk.							
Post-operative management of patients making an uncomplicated recovery from surgery for							

emphysema or the complications of such diseases.							
Management of patients following lung volume reduction surgery.							
TECHNICAL SKILLS AND PROCEDURES							
Procedures to deal with pneumothorax and bullae by open techniques.	2	2	2	4	4		Index
Procedures to deal with pneumothorax and bullae by VATS techniques.	2	2	2	4	4		Index
Lung volume reduction surgery using open, VATS and robotic techniques.	1	1	1	3	4		
Disorders of the Pericardium							
OBJECTIVE							
To fully assess and manage a patient with disease of the pericardium or pericardial space, including surgical management where appropriate, and with appropriate supervision.							
KNOWLEDGE							
Anatomy of the pericardium.							
Pathology of the pericardium.							
Pathophysiological consequences of pericardial constriction and tamponade.	3	4	4	4	4	Yes	
Clinical, echocardiographic and imaging techniques used to detect pericardial disease and assess its consequences.							
Techniques for pericardial drainage using guided needle aspiration							
Surgical drainage by subxiphoid, thoracotomy or VATS approaches.							
Surgical techniques for pericardiectomy.							
Materials used for pericardial replacement,							

their value and limitations and the situations in which used.							
Post-operative complications following resection of the pericardium and its prosthetic replacement.							
CLINICAL SKILLS							
Clinical history and examination							
Interpretation of laboratory, physiological and imaging techniques, including echocardiography.							
Recognition and assessment of pericardial tamponade and constriction.	3	4	4	4	4	Yes	
Techniques for pericardial drainage using guided needle aspiration							
Recognition of pericardial herniation and cardiac strangulation.							
Patient selection with assessment of function and risk.							
TECHNICAL SKILLS AND PROCEDURES							
OPERATIVE MANAGEMENT							
Non-complex pericardial fenestration procedures	3	4	4	4	4		
Pericardial fenestration in complex cases	1	3	4	3	4		
Pericardiectomy for relief of constriction	1	2	3	1	1		
Resection of the pericardium and replacement with prosthetic materials	1	2	2	3	4		
Disorders of the Mediastinum							
OBJECTIVE							

To fully assess and manage a patient with benign and malignant disease of the mediastinum, including surgical management where appropriate, and with appropriate supervision.							
KNOWLEDGE							
Anatomy of the mediastinum							
Congenital, benign, infective and malignant (primary and secondary) conditions of the mediastinum.							
Systemic conditions associated with the mediastinum.							
Clinical, laboratory, electromyographic and imaging techniques used in the diagnosis and assessment of patients with mediastinal disease							
Myasthenia gravis: medical, surgical and perioperative management							
Staging of thymoma and grading of myasthenia							
Benign and malignant conditions, which do not require surgical biopsy or resection.							
Oncological treatment of malignant diseases of the mediastinum, including multidisciplinary care.							
Surgical techniques for the treatment of myasthenia gravis, mediastinal cysts and tumours, complications and results.							
Retrosternal goitre and its management							
CLINICAL SKILLS							
Clinical history and examination							
Interpretation of laboratory, physiological and imaging techniques.							

Patient selection with assessment of function and risk.							
Post-operative management of patients including recognition and management of post-operative complications.							
TECHNICAL SKILLS AND PROCEDURES							
Biopsy of mediastinal masses using appropriate techniques	3	3	3	4	4		
Excision of the thymus	2	3	3	4	4		Index
Isolated resection of mediastinal cysts and tumours	2	2	2	4	4		Index
Resection of mediastinal cysts and tumours, including extended resections involving adjacent structures	2	2	2	3	4		Index
Disorders of the Airway							
OBJECTIVE							
To assess and manage a patient with disease of the major airways, including surgical management where appropriate, and with appropriate supervision.							
KNOWLEDGE							
Anatomy of the larynx, trachea and bronchus.							
Physiology of the normal airway.							
Pathophysiology of disease and its effects on lung function.							
Endoscopic appearances in health and disease.							
Congenital, inflammatory, infective, benign and neoplastic diseases of the airways.							
Symptoms, signs of airway disease.							
Clinical, physiological and imaging tests undertaken							

to diagnose and assess airway disease.							
Techniques for surgical resection of the trachea.							
Bronchoplastic procedures and the limitations of these techniques.							
Medical and oncological treatments available to deal with airway diseases.							
Endoscopic techniques used to deal with benign and malignant conditions, including disobliteration and stenting.							
Presentation, investigation and management of anastomotic complications following airway surgery.							
Presentation, evaluation and treatment of fistulae in the aerodigestive tract, due to benign, malignant and iatrogenic causes.							
Role of open and endoscopic procedures in dealing with problems.							
CLINICAL SKILLS							
Clinical history and examination							
Interpretation of laboratory, physiological and imaging techniques.							
Recognition, diagnosis and assessment of airway obstruction.	3	4	4	4	4	Yes	
Patient selection with assessment of function and risk.							
Post-operative care of patients making an uncomplicated recovery from major airway surgery.							
Post-operative care of patients making a							

complicated recovery from airway surgery.							
TECHNICAL SKILLS AND PROCEDURES							
Endoscopic assessment of a patient with airways disease	2	2	2	3	4		
Sleeve resection of the trachea for simple benign conditions	1	1	1	2	3		
Sleeve resection of the main bronchi, including lobectomy where appropriate, for malignant disease	1	1	1	2	4		
Techniques for the relief of major airways obstruction including stenting	1	1	1	2	4		
Airway resection for tumours and complex benign conditions and techniques for airway reconstruction and anastomosis	1	1	1	2	3		
Repeat resections for recurrence and the complications of prior resection.	1	1	1	2	3		
Management of fistulae in the aerodigestive tract by surgical and endoscopic techniques	1	1	1	2	3		

Transplantation

	Phase 1	Phase 2 Card	Phase 3 Card	Phase 2 Thor	Phase 3 Thor	Critical Condition	Index Proc
Intrathoracic transplantation and surgery for heart failure							
OBJECTIVE							
To be able to evaluate and manage, with appropriate supervision, some of the aspects of patients with heart failure, including operative management where appropriate. This module is intended for a trainee to gain initial exposure to this sub-speciality either as part of general cardiothoracic training or as an introduction to further advanced training in this area.							
KNOWLEDGE							

Pathophysiology and causes of heart failure.							
Pathophysiology and causes of respiratory failure.							
Transplant Immunology. Major and minor histocompatibility antigen systems. Mechanisms of immune activation and pathological consequences for transplanted organs							
Pharmacology. Drugs used in cardiac and respiratory failure. Immunosuppression and treatment of rejection.							
Indications for, contraindications to and assessment for heart transplantation.							
Indications for, contraindications to and assessment for lung and heart/lung transplantation.							
Indications for ECMO							
Indications for VAD							
Criteria for brain stem death, management of the brain-dead donor, criteria for matching donor and recipient.							
Management of patients after intrathoracic organ transplantation, including complications							
Results of heart transplantation, lung transplantation and non-transplant interventions for heart failure.							
Resynchronisation therapy: techniques and indications							
CLINICAL SKILLS							
Management of brain-dead donor							
Assessment and selection of patients for							

cardiothoracic transplantation							
Management of post op cardiothoracic transplant patient							
Management of complications of cardiothoracic transplant surgery							
Management of rejection							
TECHNICAL SKILLS AND PROCEDURES							
Transplantation							
Transvenous myocardial biopsy	1	1	2	1	2		
Donor Retrieval	1	1	2	1	2		
Ex-vivo donor organ management	2	1	2	1	2		
Implantation of heart	1	2	2	2	2		
Implantation of lung	1	2	2	2	2		
Implantation of heart/lung block	1	2	2	2	2		
Surgery for heart failure							
Surgical revascularisation for ischaemic cardiomyopathy	2	2	4	2	2		
Ventricular reverse remodelling surgery	1	2	3	2	2		
Mitral valve repair for cardiac failure	1	2	3	2	2		
Cannulation for ECMO	2	2	4	2	3		
Implantation of epicardial electrodes for resynchronisation therapy	1	2	4	2	2		
Implantation of extracorporeal VAD	1	2	2	2	2		
Implantation of intracorporeal VAD	1	2	2	2	2		

Congenital

	Phase 1	Phase 2 Card	Phase 3 Card	Phase 2 Thor	Phase 3 Thor	Critical Condition	Index Proc
Congenital Heart Disease							
OBJECTIVE							
To understand and gain experience in some of the aspects of children and adults with heart disease, including operative management where appropriate. This module is intended for a trainee to gain initial							

exposure to this sub-speciality either as part of general cardiothoracic training or as an introduction to further advanced training in this area.							
KNOWLEDGE							
Relevant general physiology of childhood							
Fetal circulation and circulatory changes at birth							
Haemodynamics; physiology and measurement including shunt calculations							
Physiology of pulmonary vasculature							
Myocardial cellular physiology in immature myocardium							
Physiology of Cardiopulmonary Bypass in children - including low flow and circulatory arrest.							
Anatomy and Embryology of the heart							
Coronary anatomy and variants							
Anatomy of the peripheral vascular system and vascular conduits including aortopulmonary shunts							
Sequential cardiac analysis and terminology of cardiac malformations							
Effect of growth and pregnancy							
Drugs used in the treatment of congenital heart disease, including perioperative management and anaesthesia							
Diagnosis, investigation and treatment of congenital heart disease							
Results of congenital surgery - survival,							

common complications and management.							
Late complications of surgery for congenital heart disease							
Role of interventional cardiology in congenital heart disease.							
Role of mechanical assist (IABP, VAD and ECMO)							
Indications for referral for transplantation in congenital heart disease							
Risk assessment and stratification in congenital surgery							
Cardiopulmonary resuscitation in children and in patients with congenital heart disease							
<u>The anatomy, pathophysiology, natural history and management of the following conditions or procedures:</u>							
Patent ductus arteriosus							
Aortopulmonary window							
Atrial septal defect							
Ventricular septal defect							
Coarctation							
PA banding and shunts							
Aortopulmonary and venous shunts							
Transposition of the great arteries / switch procedure							
Congenitally corrected TGA							
Single ventricle/univentricular heart							
Tetralogy of Fallot/Pulmonary atresia plus VSD							
Fontan procedure							
Rastelli procedure							
Hypoplastic left heart and Norwood procedure							

Norwood procedure							
Truncus arteriosus							
Double outlet right ventricle							
Pulmonary atresia plus VSD and MAPCAs							
Pulmonary atresia and intact septum							
Single ventricle							
Partial and complete atrioventricular septal defects							
Anomalies of the pulmonary venous drainage (partial and total)							
Anomalies of systemic venous drainage							
Congenital aortic valve disease (including supra-valve stenosis)							
LV outflow tract obstruction							
Sinus of valsalva aneurysm							
Congenital mitral valve disease							
Congenital tricuspid valve disease (including Ebstein's abnormality)							
Anomalies of the coronary arteries (including ALCAPA)							
Vascular rings							
Cardiac tumours							
Pericardial disease							
Aortic valve disease including Ross procedure							
Mitral valve disease							
Tricuspid valve disease including Ebstein's abnormality							
Extra cardiac conduits							
Interrupted aortic arch							
Total anomalous pulmonary venous drainage							
Extracorporeal Membrane Oxygenation and VAD							

Transplantation for congenital heart disease							
CLINICAL SKILLS							
Cardiovascular system and general history and examination of child or adult with congenital heart disease							
Routine haematology and biochemical investigations in children							
Cardiac catheterisation data including interpretation of haemodynamic data, shunt and resistance calculations							
Echocardiography in congenital heart disease, including 2D, doppler and TOE							
Principles of paediatric intensive care							
Management of adults and children following congenital heart surgery							
Management of complications of congenital surgery							
Cardiopulmonary resuscitation in children and congenital heart disease							
Diagnosis and treatment of cardiac arrhythmias in congenital heart disease							
TECHNICAL SKILLS AND PROCEDURES							
Sternotomy - open and close	2	3	4	NA	NA		
Thoracotomy - open and close	2	3	4	NA	NA		
Preparation for and management of cardiopulmonary bypass including partial bypass	2	2	3	NA	NA		

Approaches for ECMO, cannulation and management	1	2	3	NA	NA		
Surgical management of the following common uncomplicated conditions (level 1 - a higher level of operative competence is not required during this module):							
Patent ductus arteriosus	1	2	3	NA	NA		
Atrial septal defect	1	2	3	NA	NA		
Ventricular septal defect	1	1	2	NA	NA		
Coarctation	1	2	3	NA	NA		
PA banding and shunts	1	2	3	NA	NA		
Aortopulmonary window	1	1	2	NA	NA		
Vascular ring	1	1	3	NA	NA		
Aortopulmonary and venous shunts	1	1	3	NA	NA		
Surgical management of the following conditions requiring advanced procedures:							
Partial atrioventricular septal defect	1	1	2	NA	NA		
Aortic and mitral valve surgery including Ross procedure	1	1	2	NA	NA		
Open aortic valvotomy	1	1	3	NA	NA		
Open pulmonary valvotomy	1	1	3	NA	NA		
Tricuspid valve surgery including Ebstein's	1	1	1	NA	NA		
Tetralogy of Fallot/Pulmonary atresia plus VSD	1	1	1	NA	NA		
Fontan procedures	1	1	1	NA	NA		
Extra cardiac conduits and their replacement	1	1	2	NA	NA		
Complete atrioventricular septal defect	1	1	1	NA	NA		
Surgical management of the following conditions requiring complex procedures:							
Interrupted aortic arch	1	1	1	NA	NA		
Total anomalous pulmonary venous drainage	1	1	1	NA	NA		

Transposition of the great arteries (switch procedure)	1	1	1	NA	NA		
Rastelli procedure	1	1	1	NA	NA		
Norwood procedure	1	1	1	NA	NA		
Truncus arteriosus repair	1	1	1	NA	NA		
Double outlet right ventricle	1	1	1	NA	NA		
Pulmonary atresia plus VSD and MAPCAs	1	1	1	NA	NA		

Generic Cardiothoracic

	Phase 1	Phase 2 Card	Phase 3 Card	Phase 2 Thor	Phase 3 Thor	Critical Condition	Index Proc
Critical Care and Post-operative Management							
OBJECTIVE							
To be able to manage a post-surgical patient on the critical care, high dependency and post-operative wards. To work as part of a multi-professional, multidisciplinary team in the management of a patient requiring complex critical care. Competence in the management of uncomplicated situations should be achieved during this period. Management of complicated or difficult situations will require appropriate supervision and guidance.							
KNOWLEDGE							
BASIC KNOWLEDGE							
Physiology							
Haemodynamics: physiology and measurement							
Cardiac arrhythmia							
Haemostasis, thrombosis and bleeding							
Acid base balance							
Pulmonary physiology, ventilation and gas exchange							
Metabolic response to trauma and surgery							
GIT, renal and hepatic physiology							
Nutrition							
Temperature regulation							
Anatomy							
Heart, pericardium and great vessels							
Mediastinum, thoracic inlet and neck							
Tracheobronchial tree and lungs							
Chest wall and diaphragm							
Pathology							
Inflammation and wound healing							
Myocardial infarction and complications							
Endocarditis	4	4	4	4	4	Yes	
Pericarditis							
Systemic Inflammatory Response Syndrome							

Bronchopulmonary infection							
ARDS							
Pharmacology							
Drugs used in the treatment of hypertension, heart failure and angina							
Inotropes, vasodilators and vasoconstrictors							
Anti-arrhythmic drugs							
Haemostatic drugs							
Antiplatelet, anticoagulant and thrombolytic drugs							
Analgesics							
Antibiotics							
Anaesthetic agents, local and general							
Microbiology							
Organisms involved in cardiorespiratory infection							
Antimicrobial treatment and policies							
CLINICAL KNOWLEDGE							
Cardiopulmonary resuscitation							
Management of cardiac surgical patient							
Management of thoracic surgical patient							
Treatment of cardiac arrhythmia							
Management of complications of surgery	3	4	4	4	4	Yes	
Blood transfusion and blood products							
Wound infection and sternal disruption							
Neuropsychological consequences of surgery and critical care							
CLINICAL SKILLS							
HISTORY AND EXAMINATION							
History and examination of the post-operative and critically ill patient							

DATA INTERPRETATION							
Analysis and interpretation of post-operative and critical care charts and documentation							
Routine haematology and biochemical investigations							
Chest radiograph and ECG							
Echocardiography including TOE							
PATIENT MANAGEMENT							
General management of surgical patient							
Management of fluid balance and circulating volume							
Pain control							
Wound management							
Management of surgical drains							
Antimicrobial policy and prescribing							
Management of postoperative haemorrhage	3	4	4	4	4	Yes	
Cardiopulmonary resuscitation (ALS)	3	4	4	4	4	Yes	
Management of complications of surgery	3	4	4	4	4	Yes	
Blood transfusion and blood products							
Wound infection and sternal disruption							
Recognition, evaluation and treatment of haemodynamic abnormalities							
Evaluation and interpretation of haemodynamic data							
Practical use of inotropes and vasoactive drugs							
Use of an intra-aortic balloon pump (IABP)							
Recognition, evaluation and treatment of cardiac arrhythmias							
Interpretation of ECG							

Use of antiarrhythmic drugs							
Use of defibrillator							
Understanding and use of cardiac pacing							
Recognition, evaluation and treatment of ventilatory abnormalities							
Interpretation of blood gas results							
Airway management							
Understanding of ventilatory techniques and methods							
Understanding of anaesthetic drugs and methods							
Recognition, evaluation and treatment of multi-organ dysfunction							
Renal dysfunction and support							
GIT dysfunction, feeding and nutrition							
Recognition and evaluation of cerebral and neuropsychological problems							
TECHNICAL SKILLS AND PROCEDURES							
PRACTICAL SKILLS							
Arterial cannulation	4	4	4	4	4		
Central venous cannulation	4	4	4	4	4		
Insertion of Swan Ganz PA catheter (including measurement of cardiac outputs and interpretation of results)	4	4	4	4	4		
IABP insertion	3	4	4	4	4		
IABP timing and management	3	4	4	4	4		
Tracheostomy	1	2	3	3	4		
Fibreoptic bronchoscopy	2	3	4	3	4		
Chest aspiration	4	4	4	4	4		
Chest drain insertion	4	4	4	4	4		
Chest drain management	4	4	4	4	4		
Establish an airway	2	3	4	3	4		

Internal Cardiac Massage	2	3	4	3	4		
OPERATIVE MANAGEMENT							
Re-exploration for bleeding or tamponade	2	3	4	3	4	Yes	
Cardiothoracic Trauma							
OBJECTIVE							
To evaluate and manage, including surgical management where appropriate, and as part of a multidisciplinary team, a patient with thoracic trauma.							
KNOWLEDGE							
GENERAL TRAUMA MANAGEMENT							
Principles of trauma management (as defined by ATLS®)							
Principles of emergency resuscitation following cardiac arrest							
SPECIFIC KNOWLEDGE							
The mechanism and patterns of injury associated with blunt, penetrating, blast and deceleration injuries to the chest							
The post- ATLS®, definitive care of blunt, penetrating and deceleration injuries to the chest.							
The indications and use of appropriate investigations in thoracic trauma management							
Pain relief in chest trauma, including epidural anaesthesia.							
Indications for immediate, urgent and delayed thoracotomy in trauma							
CLINICAL SKILLS							
GENERAL TRAUMA MANAGEMENT (ATLS®)							

Assessment and management of airway, breathing and circulation							
Maintenance of an adequate airway and respiratory support							
Protection of the cervical spine							
Circulatory resuscitation							
Establishment of appropriate monitoring							
Assessment and management of pain and anxiety							
CARDIOTHORACIC TRAUMA MANAGEMENT							
Examination and assessment of the of the chest, including respiratory, cardiovascular and circulatory systems							
Recognition and management of immediately life threatening situations: obstructed airway, tension pneumothorax, massive haemothorax, open chest wound, flail chest and cardiac tamponade	4	4	4	4	4	Yes	
Recognition and management of potentially life threatening situations: lung contusion, bronchial rupture, blunt cardiac injury, intrathoracic bleeding, oesophageal injury, simple pneumothorax and major vascular injury	3	4	4	4	4	Yes	
Recognition of potentially life threatening penetrating injuries to the chest and abdomen	3	4	4	4	4	Yes	
Interpretation of chest x-ray, ECG, arterial blood gases and echocardiography							

Detection and treatment of cardiac arrhythmias							
Management of the widened mediastinum including appropriate investigations and multidisciplinary consultation	2	4	4	4	4	Yes	
TECHNICAL SKILLS AND PROCEDURES							
PRACTICAL SKILLS							
Establish an emergency airway (surgical and non-surgical)	2	3	4	3	4		
Insertion and management of thoracic drains	4	4	4	4	4		
Establish adequate venous access and monitoring.	2	3	4	3	4		
OPERATIVE MANAGEMENT OF THORACIC TRAUMA							
Posterolateral thoracotomy, anterolateral thoracotomy and thoracolaparotomy	2	3	4	3	4		
Bilateral anterior thoracotomy	2	3	4	4	4		
Median sternotomy and closure	3	4	4	4	4		
Repair of cardiac injuries	2	3	3	3	3		
Repair of pulmonary and bronchial injuries	1	2	3	3	4		
Operative management of fractured ribs and flail chest	1	2	2	3	4		
Management of the complications of chest trauma, including retained haemothorax and empyema	1	3	3	3	4		
Repair of oesophageal injuries	1	1	1	2	2		
Treatment of aortic transection	1	1	2	1	1		