



الهيئة السعودية للتخصصات الصحية
Saudi Commission for Health Specialties

Cardiac surgery program



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

CONTRIBUTORS

Prepared and updated by Curriculum Scientific Group
Dr. Fareed Khouqeer Dr. Yasser Elghoneimy Dr. Haitham Albar
Supervision by
Dr, Ali Alshehri Dr, Nouf Alrumaihi
Reviewed and Approved by
Dr, Ali Assiri

This curriculum may contain sections outlining some regulations of training; however, such regulations need to be in compliance with the most up-to-date general bylaws and executive policies of the Saudi Commission for Health Specialties (SCFHS), which can be accessed online through the official SCFHS website.

As this curriculum is subject to periodic refinements, please refer to the electronic version posted online for the most updated edition:

<https://www.scfhs.org.sa/MESPS/TrainingProgs/TrainingProgsStatement/Pages/index.asp>

COPYRIGHT STATEMENT

All rights reserved. ©2020 Saudi Commission for Health Specialties. This material may not be reproduced, displayed, modified, distributed, or used in any other manner without prior written permission of the Saudi Commission for Health Specialties, Riyadh, Kingdom of Saudi Arabia. Any amendment to this document shall be endorsed by the specialty scientific council and approved by central training committee. This document shall be considered effective from the date the updated electronic version of this curriculum is published on the commission's Website, unless a different implementation date has been mentioned.

Correspondence: Saudi Commission for Health Specialties

PO Box: 94656

Postal Code: 11614

Contact Center: 920019393

E-mail: Curricula@scfhs.org.sa

Website: www.scfhs.org.sa

FOREWORD

The Saudi Medical Education Directions for Cardiac Surgery training program is now and for the first time a competency framework designed for all cardiac surgeons practicing in the kingdom who wish to pursue a career in the specialty. This version provides a guiding framework that is utilized in some competency definitions and descriptions of sub-competencies in each domain. Upon completion of the educational program, the graduate physician will be competent to function as a consultant in cardiac surgery.

Significant design and development concepts have been implemented in the rotations' structure, evaluation, and assessment processes, and included in the detailed descriptions of competencies based on feedback from the scientific council and program directors, as the major involvement of trainee residents. The curriculum development committee would also like to thank all those who participated in the various stages of development, from planning to analysis of the current situation, to devising development mechanisms through focus group discussions and expert input, as well as reviewing the available evidence. These efforts were crowned by reviewing the curriculum drafts and amending their formulation and design to come out in this distinguished form.

The curriculum development committee sincerely thanks the scientific group of the previous curriculum for its effort and excellent work. Part of this work was based on the previous curriculum.

The curriculum development committee would like to share its profound appreciation for the various committees, colleagues, and residents all over the kingdom who have contributed to the development of this curriculum, for their hard work and commitment, without which this edition would not have been possible.

This new edition of the curriculum is fully supported and endorsed by the scientific council for cardiac surgery residency training in the SCFHS (1). It is very important to stress that we need support from all program directors, consultants, educational and training leadership in different training centers, and all the residents with great synchrony and collaboration to take these visionary steps. Cooperation and support from the SCFHS executive leadership and supporting staff is essential for the success of this program.

Finally, we would remind ourselves and others that this curriculum is only one step among many into the bright future of further learning cycles, as it will always be subjected to supplementary refinements and a continuous quality improvement process, especially as we aim to be among the SCFHS' new generation of training programs that implement an entrustable professional activities (EPAs) model.

TABLE OF CONTENTS

CONTRIBUTORS	1
COPYRIGHT STATEMENT	3
FOREWORD	4
INTRODUCTION	6
ABBREVIATIONS USED IN THIS DOCUMENT	8
PROGRAM STRUCTURE	10
LEARNING AND COMPETENCIES	17
ACADEMIC ACTIVITIES	52
5C Course	54
ASSESSMENT OF LEARNING IN CARDIAC SURGERY RESIDENCY PROGRAM	55
POLICIES AND PROCEDURES	64
APPENDICES	65
APPENDIX A	66
APPENDIX B	68
APPENDIX C	70
APPENDIX D	72
APPENDIX E	75
APPENDIX F	77
APPENDIX G	92
GLOSSARY	96
REFERENCES	98

INTRODUCTION

The Saudi Medical Education Directions for Cardiac Surgery training program (SaudiMED-CS 2020) is a competency framework designed for all cardiac surgeons practicing in the kingdom who wish to pursue a career in the specialty (2). This version provided a guiding framework utilized in some competency definitions and descriptions of sub-competencies in each domain. This framework was adapted in conceptual frameworks from CanMEDS-2015, ACGME, and with the ambitions of the national vision 2030 new model of care (3, 4).

General Objectives

On completion of the educational program, the graduate physician will be competent to function as a consultant in cardiac surgery. Residents must:

1. Demonstrate the knowledge relating to cardiac surgery.
2. Demonstrate an ability to incorporate pertinent perspectives in research methodology, data presentation, analysis, and interpretation.
3. Endeavor to deliver the highest quality care with integrity, honesty, and compassion as a dedicated professional, and consistent with the obligations of a physician.
4. Exhibit appropriate personal and interpersonal professional behavior and practice medicine ethically, giving priority to the needs of individual patients.
5. Take part in continuing education and evaluation throughout the cardiac surgeon's professional life, including an appreciation for the role of research and the need for the critical analysis of current scientific and practice developments related to the specialty.

It is expected that all graduates of this program shall be law-abiding individuals, respecting the professional code of conduct toward patients, colleagues, and institutions.

1. Context of Practice

Global and national demands of the cardiac surgery specialty:

In 2015, there were an estimated 422.7 million cases of cardiovascular diseases (CVD) worldwide and 17.92 million CVD deaths (5). World Health Organization statistics reveal that the incidence of cardiovascular diseases in Saudi Arabia was 0.1% in 2011 (6). And in the year 2015, there were 143,131 outpatient visits for ischemic heart disease while there were 214,113 visits for those for rheumatic heart disease. There were 1,156,931 patients with hypertension, and 1,185,765 with cardiovascular disease in the same year (7). In 2018 there were 29,613 cardiovascular and thoracic surgeries performed around the kingdom (8). Needs assessments, especially special learning needs related to one's specialty, is underway by members of the Scientific Council, where we expect the results will be verified by the end of 2020.

2. Patient Profile

The cardiac surgery program will enable residents to interact with all sorts of patients, both adult and pediatric patients, in outpatient as well as inpatient settings, elective and emergency conditions. Future needs and/or challenges will be continually assessed, and surgeons will be challenged to make the training program the best it can be in the international arena.

3. Goal and Responsibility of the Cardiac Surgery Curriculum

The goal of this curriculum is to guide training centers, trainers, and trainees to become competent functional cardiac surgeons in their own community through the coordinated efforts of all stakeholders.

Responsibility of curriculum implementation

The program director has the vital role of leading the whole team in the successful implementation of this curriculum. Training committee members, the chief resident, trainees, academic affairs, scientific councils or committees, and all healthcare-related personnel work together as one team for a successful program.

What is new in this edition?

- A competency-based curriculum has been established, with an explicit representation of the learning domains (knowledge, skills, and behaviors).
- There is now graded responsibility for the trainee, with what should be achieved at each stage of training (milestones).
- Better supervisory frameworks now support independent learning in a formal structure, and enriched formative and summative assessments.
- Significant changes have been made in the rotations in both stages of junior and senior years, based on feedback from program directors, members of the scientific council, consultants, as well as residents and trainees in cardiac surgery.
- All changes regarding rotations now actively support knowledge, skills, and attitudes related to cardiac surgery.
- The total number of cases to be performed by the trainee residents are specified in each year as a basic guide for development of their skills.
- The evaluation and assessment section for trainee residents is new, which will implement more practical ways of evaluation during rotations in addition the examinations.
- Requirements for research also have been modified to be more beneficial to the trainee residents.

ABBREVIATIONS USED IN THIS DOCUMENT

Abbreviation	Description
ABG	Arterial blood gases
ACGME	The Accreditation Council for Graduate Medical Education
ACLS	Advanced cardiovascular life support
AMA	American Medical Association
ARDS	Acute respiratory distress syndrome
ASD	Atrial septal defect
ATLS	Advanced trauma life support
AVR	Aortic valve replacement / repair
BLS	Basic life support
CV	Curriculum vitae
CABG	Coronary artery bypass graft
CanMEDS	The Canadian Medical Education Directives for Specialists
CATH LAB	Cardiac catheterization lab
CBD	Case-based discussion report
CBDandP	Case-based discussion and presentaton
CBE	Competency-based education
CCU	Coronary care unit
CHD	Congenital heart disease
CMR	Cardiac magnetic resonance imaging
CO	Cardiac output
COPD	Chronic obstructive airways disease
COVID-19	Coronavirus disease 2019
CPB	Cardiopulmonary bypass
CPR	Cardiopulmonary resuscitation
CSICU	Cardiac surgery intensive care unit
CT	Computerized tomography
CVA	Cerebral vascular accident
CVD	Cardiovascular diseases
CXR	Chest radiograph (chest X-ray)
DOPS	Direct observation of procedural skills
EBM, EBP	Evidence-based medicine, evidence-based practice
ECMO, ECLS	Extracorporeal membrane oxygenation, also known as extracorporeal life support
EKG, ECG	Electrocardiography, electrocardiogram
EMR, EHR	Electronic medical records, electronic health record
EPA	Entrustable professional activities
ER, ED	Emergency room, emergency department
FAST	Focused assessment sonography in trauma
FCCS	Fundamental critical care support
FINER	Feasible, interesting, novel, ethical, and relevant
FITER	Final in-training evaluation report
GI	Gastrointestinal
H2 antagonists	Histamine H2-receptor antagonists, commonly called H2 blockers

ABBREVIATIONS USED IN THIS DOCUMENT

IAA	Interrupted aortic arch
IABP, IACP	Intra-aortic balloon pump, intra-aortic counter pulsation
ICU	Intensive care unit
IRB	Institutional review board
ITER	In-training evaluation report
LMA	Laryngeal mask airway
LV, RV	Left ventricle, right ventricle
MandM	Morbidity and mortality
MBTS	Modified Blalock–Taussig shunt
MR	Mitral regurgitation
MRI, MRA	Magnetic resonance imaging, magnetic resonance angiography
MVR	Mitral valve replacement / repair
ONE45	Medical education management software
OR	Operation room
PA	Pulmonary atresia
PCA	Patient-controlled analgesia
PCI	Percutaneous coronary intervention
PDA	Patent ductus arteriosus
PET SCAN	Positron emission tomography scan
PFT	Pulmonary function tests
PGY1	Postgraduate year 1
PONV	Postoperative nausea and vomiting
PPE	Personal protective equipment
QI	Quality improvement
R(1), R1,	(First) year of residency
RPC	Research resident program committee
RTC	Residency training committee
RV to PA conduit	Right ventricle to the pulmonary artery (RV-PA) conduit
SAM	Systolic anterior motion
SCFHS	Saudi Commission for Health Specialties
SYNTAX Trial	Synergy between percutaneous coronary intervention with taxus and cardiac surgery trial
TAPVD (TAPVR, TAPVC)	Total anomalous pulmonary venous drainage (return, connection)
TAVI	Transcatheter aortic valve implantation
TB	Tuberculosis
TEVAR	Thoracic endovascular aortic repair
TGA	Transposition of the great arteries
TOF	Tetralogy of Fallot
TTE, TEE	Transthoracic and transesophageal echocardiography
TVR	Tricuspid valve replacement/repair
USMLE	The United States Medical Licensing Examination
VAD, LVAD, RVAD, bi-VAD	Ventricular assist device, left ventricular assist device, right ventricular assist device, biventricular assist device
VATS	Video-assisted thoracoscopic surgery
VSD	Ventricular septal defect

PROGRAM STRUCTURE

1. Program Entry Requirements

Admission: The selection process is governed by the SCFHS. Up-to-date information and dates for applications and essential documents can be easily found in the SCFHS web pages.

<https://www.scfhs.org.sa/en/MESPS/Admissions%20and%20Registration/Conditions%20of%20admission%20and%20registration/Pages/default.aspx>

Conditions for applying for graduate programs (human medicine, dentistry, pharmacy, applied medical sciences, nursing):

- A. Obtain a bachelor of medicine degree and a bachelor of surgery degree from a Saudi university or its equivalent from recognized universities.
- B. Obtain a certificate of completion of the internship year.
- C. Provide positive identification (national identity/passport/residence)
- D. Provide a recent personal photograph.
- E. Provide a copy of your academic record.
- F. Be medically fit.
- G. Pass the Saudi medical licensing exam held by the Saudi Commission for Health Specialties.

Additional discriminating points can be imposed by different program administrations, which may affect resident ranking in their acceptance list. These may include, but are not limited to, the following academic and non-academic spheres, such as;

- English language proficiency certificate and grades transcript
- Years of experience in a cardiac center
- ACLS certificate
- Research work
- USMLE Step 1 certificate
- USMLE Step 2 certificate
- ATLS certificate
- BLS certificate
- FCCS basic critical care certificate
- Video game skills
- Community initiatives and volunteerism

Training Requirements

- a) Training is a full-time commitment. Residents shall be enrolled in continuous full-time training for the entire seven-year training period as designed.
- b) Training is to be conducted under the auspices of institutions accredited by the designated committee in SCFHS or approved by the scientific council of cardiac surgery.
- c) Training shall be comprehensive and include all aspects specified in the accreditation certificate from the designated committee in SCFHS.
- d) Trainees shall be actively involved in patient care, with a gradual progression of responsibility in the assigned rotations.
- e) Trainees shall abide by the training regulations and obligations as set by the SCFHS, the policies and procedures of the training centers, and by the laws of the kingdom.

2. Program Duration

The duration of the cardiac surgery training program is seven years. Training is structured so that a coherent and integrated educational program with progressive resident responsibility and entrusted competencies is ensured. Education is designed through a process of clinical rotations, clinical exposure, and progressive involvement in direct patient care, with multitude of formative residents' assessments as they continue to add to their overall knowledge and skills. The training consists of two phases:

First phase (junior level): Five (5) years (156 weeks as Junior Residency in General Cardiac surgery and 104 weeks as Junior Residency in Specialty Cardiac Surgery), R1–R5.

Second phase (senior level): Two (2) years (104 weeks) R6–R7

PHASE	NAME	Period of Training
JUNIOR	Junior Residency in General Cardiac surgery	156 Weeks
	Year 1, Year 2 and Year3	
	Junior Residency in <i>Specialty</i> Cardiac Surgery	104 Weeks
	Year 4 and Year 5	
SENIOR	Senior Residency in <i>Specialty</i> Cardiac Surgery	104 Weeks
	Year 6 and Year 7	

3. Program Rotations

A. Phase I: Junior Level Training for Cardiac Surgical Residency Program

This is a structured program of junior level rotations:

Three years (156 weeks) will be done in collaboration with the other board programs, in a center approved by the scientific council, under the supervision of the cardiac surgery program director. It encompasses education in basic sciences, training in cognitive and technical skills, development of clinical knowledge and maturity, and acquisition of surgical judgment. It is mandatory that all residents start their residency training program with cardiac surgery rotation for 12 weeks in the training center that the resident is enlisted under. The residents will rotate through different general and specialty specific rotations through the first three years in training. The schedule for these rotations is different from one resident to another based on the available training time that is assigned for each resident. Thesis variations will not affect the residents' promotion or eligibility to sit for the exams as long as they have finished all the required rotations.

PROGRAM STRUCTURE

The next 2 years (104 weeks) of this structured program of junior level training will be rotations in specialty cardiac surgery in collaboration with the other board programs, in a center approved by the scientific council (as per policy concerning independent vs. joint programs), under the supervision of the cardiac surgery program director. It encompasses education in basic sciences, training in cognitive and technical skills, development of clinical knowledge and maturity, and acquisition of surgical judgment through specific rotations in Adult Cardiac Surgery (48 weeks), Pediatric Cardiac Surgery (24 weeks), Vascular Surgery (12 weeks), and Thoracic Surgery (12 weeks). The schedule for these rotations is different from one resident to another based on the available training time that is assigned for each resident. Thesis variations will not affect the residents' promotion or eligibility to sit for the exams as long as they have finished all the required rotations.

Junior Level Training	Training year	Mandatory core rotations*		Elective rotations**		Selective rotations***	
		Rotation name	Duration	Rotation name	Duration	Rotation name	Duration
Junior Residency in General Cardiac surgery (156 weeks)	R1 first rotation	Cardiac Surgery	12 weeks				
	R1 rest of rotations and R2 and R3	General Surgery	24 weeks				
		Research	24 weeks				
		Cardiac Surgery	12 weeks				
		ICU	24 weeks				
		Thoracic Surgery	8 weeks				
		Vascular Surgery	8 weeks				
		Trauma	8 weeks				
		Cardiology / CCU	8 weeks				
		Cath Lab	8 weeks				
		Echocardiography	4 weeks				
		Cardiac Anesthesia	4 weeks				
		R1	Vacation	4 weeks			
	R2	Vacation	4 weeks				
	R3	Vacation	4 weeks				

Junior Residency in Specialty Cardiac Surgery (104)	R4 and R5	Adult Cardiac Surgery	48 weeks				
		Pediatric Cardiac Surgery	24 weeks				
		Vascular Surgery	12 weeks				
		Thoracic Surgery	12 weeks				
	R4	Vacation	4 weeks				
	R5	Vacation	4 weeks				

***Mandatory core rotation: Set of rotations that represent program core component and are mandatory to do.**

****Elective rotation: Set of rotations that are related to the specialty, as determined by the scientific council/committee, and the trainee is required to do some of them.**

*****Selective rotation: Set of other rotations that is selected by the trainee (directed by mentor/program director) to enhance the competency acquisition of the specialty).**

Junior-level (R1–5) competency matrix to map competency, earning domains, and milestones, as detailed in Appendix A.

B. Phase II: Senior Level Training for Cardiac Surgical

Residency Program

This is a structured program of senior level rotations in **Specialty Cardiac Surgery** for two years (104 weeks) will be done in collaboration with the other board programs, in a center approved by the scientific council, under the supervision of the cardiac surgery program director.

A candidate can get to this level of senior training through one of the following tracks:

Track 1:

Promotion to the senior years depends on the successful completion of Phase 1 junior-level training, and passing Part 1 of the Cardiac Surgery Examination.

Track 2:

Candidates with full certification from the board of general surgery or its equivalent as

recognized by the Saudi Council for Health Specialty will be considered for cardiac surgery residency training R4 (Year 4) after discussion and approval by the scientific committee.

The certification of a candidate who has completed a full residency training in another country in a recognized residency training program in cardiac surgery and has the ambition to be granted certification in cardiac surgery by the SCFHS will be handled by the scientific council and the concerned related departments in the SCFHS.

Senior trainees shall be responsible for performing basic and clinical hospital activities such as:

1. Inpatient care in their unit, especially clerking and following the admitted patients, with timely completion of patients' medical records, including a complete history and physical examination, an investigation of requests and results, a plan of management, postoperative orders and progress notes, a discharge summary, and other relevant reports.
2. The trainees shall attend specialty surgical outpatient clinics at least once weekly and participate in the management plans of the surgical patients under the supervision of the senior staff member.
3. Trainees shall be required to attend and participate in the operative sessions conducted in the operating rooms, outpatient units, or day surgery units, keeping an accurate and precise logbook throughout.
4. Trainees shall have minimum average on-call duty (24 hours duty) of one in every four nights, 70 times per year (one in every four nights even during the elective research rotation).
5. Trainees shall maintain healthy relations with patients, their relatives, and medical, nursing, and administrative staff.
6. Trainees shall maintain the confidentiality and ethics of the profession and shall abide by the governing rules and the laws of the Kingdom of Saudi Arabia.
7. The program provides an opportunity for residents to learn and attain prescribed competencies. The program provides experience in preoperative, operative, and postoperative care of patients in all areas that constitute the principal components for subspecialties related to cardiac surgery. Objectives and designated level of competency are tabulated in the master roadmap along with assessment projection examples from which the scientific council will select and announce at the beginning of each academic year.

The following is the required rotation for the senior years of training. The senior residents will rotate through the adult cardiac surgery rotation and the pediatric cardiac surgery rotation. The schedule for these rotations differs from one resident to another based on the available training time that assigned for each resident. These variations will not affect the resident promotion or eligibility to set for the exams as long as the resident finished all the required rotations. It is mandatory that all senior residents will spend the final year of training in adult cardiac surgery rotation or any subspecialty/subsection that is related to the cardiac surgery rotations, such as minimal invasive cardiac surgery, heart failure, transplant surgery, or arrhythmia surgery.

PROGRAM STRUCTURE

Senior Level Trainee	Training Year	Mandatory core rotations*		Elective rotations**		Selective rotations***	
		Rotation name	Duration	Rotation name	Duration	Rotation name	Duration
Senior level rotations in Specialty Cardiac Surgery for two years (104 weeks)	R6 and R7	Adult Cardiac Surgery	72 weeks				
		Cardiac Surgery subsection	24 weeks				
	R6	Vacation	4 weeks				
	R7	Vacation	4 weeks				

*Mandatory core rotation: Set of rotations that represent program core component and are mandatory to do.

**Elective rotation: Set of rotations that are related to the specialty, as determined by the scientific council/committee, and the trainee is required to do some of them.

***Selective rotation: Set of other rotations that is selected by the trainee (directed by mentor/program director) to enhance the competency acquisition of the specialty).

Senior-level (R6–R7) competency matrix to map competency, learning domains, and milestones, as detailed in Appendix B.

PHASE	NAME	Period of Training
JUNIOR	Junior Residency in General Cardiac surgery	156 Weeks
	Year 1, Year 2 and Year3	
	Junior Residency in Specialty Cardiac Surgery	104 Weeks
	Year 4 and Year 5	
SENIOR	Senior Residency in Specialty Cardiac Surgery	104 Weeks
	Year 6 and Year 7	

- A. Therefore, **Junior Residents' levels** are from R1-R5 accordingly:
- **Junior Residency in General Cardiac surgery** Year 1, Year 2 and Year3
 - **Junior Residency in Specialty Cardiac Surgery:** Year 4 and Year 5
- B. Junior residents who are allowed to enter Saudi Board P1 are R2,3,4,5
- C. Failing Part 1 Exam will not prevent promotion from R2, R3, and R4 to the next level. Promotion from R5 to R6 is only permitted by passing Part 1 Exam in addition to fulfilling the Formative Assessments

Distribution of rotations over the years:

The following table show example of the distribution of rotations with the specified four-week annual vacations over the training years (seven years)

BLOCK / R level	BLOCK 1 = 4 WEEKS	BLOCK 2 = 4 WEEKS	BLOCK 3 = 4 WEEKS	BLOCK 4 = 4 WEEKS	BLOCK 5 = 4 WEEKS	BLOCK 6 = 4 WEEKS	BLOCK 7 = 4 WEEKS	BLOCK 8 = 4 WEEKS	BLOCK 9 = 4 WEEKS	BLOCK 10 = 4 WEEKS	BLOCK 11 = 4 WEEKS	BLOCK 12 = 4 WEEKS	BLOCK 13 = 4 WEEKS
R1	CARDIAC SURGERY FIRST ROTATION = 12 WEEKS			GENERAL SURGERY = 24 WEEKS						ECHO = 4 WEEKS	RESEARCH R1 = 8 WEEKS	VACATION = 4 WEEKS	
R2	TRAUMA = 8 WEEKS	THORACIC = 8 WEEKS	VASCULAR = 8 WEEKS		ICU, GENERAL = 6 WEEKS And CARDIAC SURGERY ICU = 8 WEEKS			ANAESTHESIA = 4 WEEKS	RESEARCH R2 = 8 WEEKS	VACATION = 4 WEEKS			
R3	CARDIAC SURGERY = 12 WEEKS		CARDIAC SURGERY ICU CSICU = 12 WEEKS			CARDIAC CATH = 8 WEEKS	CCU and CARDIOLOGY = 8 WEEKS		RESEARCH R3 = 8 WEEKS	VACATION = 4 WEEKS			
R4	THORACIC = 8 WEEKS	VASCULAR = 8 WEEKS		ADULT CARDIAC SURGERY = 32 WEEKS						VACATION = 4 WEEKS			
R5	ADULT CARDIAC SURGERY = 24 WEEKS						PED CARDIAC SURGERY = 24 WEEKS				VACATION = 4 WEEKS		
R6	ADULT CARDIAC SURGERY = 48 WEEKS												VACATION = 4 WEEKS
R7	ADULT CARDIAC SURGERY = 24 WEEKS						SUBSECTION CARDIAC SURGERY = 32 WEEKS				VACATION = 4 WEEKS		

Lists of the top conditions and procedures in the specialty are detailed in Appendix D.

The scope of procedures in the cardiac surgery training program are detailed in Appendix E.

LEARNING AND COMPETENCIES

1. Introduction to Learning Outcomes and Competency-Based Education

What is being introduced in postgraduate training throughout the world is more correctly called “outcome-based education” and is the basis of the General Medical Council’s Good Medical Practices (9), the role of CanMEDS in Canada (10), the Accreditation Council for Graduate Medical Education outcomes in the USA (11), and the “Scottish doctor” project (12). An outcome is defined as “a culminating demonstration of learning,” as not only must doctors have the technical competence to treat a patient, but they must also understand why they are doing it; they should adopt appropriate critical thinking to what they are doing; use appropriate decision-making strategies; and adopt appropriate attitudes toward their patients (13). It is what the trainee should be able to do by the end of training. They must also put their approach to patient management in the context of the overall healthcare delivery system, and at the same time be able to assess their own competence in the area and keep up to date with current specific learning objectives developments. In other words, “doing the right thing, doing the thing right, and the right person doing it” (14). Different teaching and learning styles may be employed as long as the trainee is facilitated in achieving the outcomes.

Competency-based training relies on breaking down a practice into its definable or measurable components and training learners to perform each part to a particular standard. It does not provide for the complex thinking and the deep understanding of the practice that is so essential for creating competent surgeons (15). That issue will be addressed in the anticipated revision soon to be addressed by the Scientific Council in the next project of upgrading this curriculum to the entrusted professional activities model for implementation, hopefully in 2021.

2.1.1. CanMEDS physician competency framework (2)

Rotations have three main components:

1. Duties
2. Safety
3. Learning

Those intertwine knowledge, skills, and attitude. On the outcome side of things, they blend again to fit the frameworks of the CanMEDS competencies.

The following summarizes key roles for physicians in the CanMEDS 2015 project:

- Medical Expert
- Communicator
- Collaborator
- Leader
- Health Advocate
- Scholar
- Professional

2.2. Specific (rotation-based) competencies

1. Competency-based learning and teaching template base for all rotations
2. Competency-based learning and teaching during first cardiac surgery rotation
3. Competency-based learning and teaching during general surgery rotation
4. Competency-based learning and teaching during general and cardiac surgical ICU rotations
5. Competency-based learning and teaching during trauma rotation
6. Competency-based learning and teaching during thoracic surgery rotation
7. Competency-based learning and teaching during vascular rotation
8. Competency-based learning and teaching during cardiology-CCU rotation
9. Competency-based learning and teaching during cardiac catheterization rotation
10. Competency-based learning and teaching during research rotation
11. Competency-based learning and teaching during adult cardiac surgery rotation
12. Competency-based learning and teaching during pediatric cardiac surgery rotation
13. Competency-based learning and teaching during subspecialty cardiac surgery rotation

General Principles for Each Rotation

Trainees are expected to progress from novice to mastery levels in a certain set of professional competencies. SCFHS has endorsed the CanMEDS to articulate professional competencies (2, 3).

Residents are expected to acquire a set of knowledge and skills in each rotation and adhere to general professional behavior and attitude in all rotations as follows.

Attitude

The residents will be monitored during his/her daily activities for his attitude and behavior skills. The top behavior skills that are required to be achieved by cardiac surgery residents before graduation are synergistic, mainly to ensure good interpersonal communication skills. Residents are expected to act in the patients' best interests according to the level of their expected responsibility, and to communicate appropriately with medical personnel and the patients and their families. Residents are expected to behave in an empathetic manner with the patients and take appropriate consideration of cultural issues while dealing with patients. Residents are expected to be responsible for their patients' safety and exhibit that behavior in preoperative, intraoperative, and postoperative management with a high degree of confidentiality.

Paying attention to attitude in all targeted competencies to be stressed throughout the rotation and to be given timely and appropriate feedback to the trainee. That is a major intertwining task of program director or his or her designees.

Competency-based learning and teaching during the first cardiac surgery rotation

This is the first rotation in the program. The candidate should have this rotation at his medical center to be familiar with the team in his home hospital. The duration of this rotation is three months.

During this rotation, the candidate is expected to attend a two-week boot camp to prepare him or her with the knowledge, skills, and attitude required during the first three years of the program (surgical foundation).

All the required CanMEDS roles will fulfilled during this rotation, as described in the basic template, in addition to the following:

A. Knowledge

Attends hospital/department orientation

Attend cardiac surgery boot camp to address basic hospital and clinical skills

Attend basic life support (BLS) course.

Attend advanced cardiac life support (ACLS) course.

Describe/attend performance improvement plan (PIP) for quality improvement.

Describe/attend patient safety and safety in the healthcare facility.

- i. Ischemic Heart Disease—Medical Knowledge
 - Identify basic anatomy and pathology of the heart
 - Explain common variations in anatomy and pathology (e.g., left dominant system)
 - Identify coronary anatomy on angiogram
 - Describe basic cellular and vascular physiology
 - Describe physiologic changes accompanying ischemic heart disease (e.g., ischemia, ischemia reperfusion injury, infarction, recovering myocardium)
 - List clinical manifestations of ischemic heart disease (e.g., angina, myocardial infarction) and its differential diagnosis
 - List diagnostic tools available for evaluation of ischemic heart disease
 - Explain EKG
 - List treatment options for ischemic heart disease (e.g., coronary artery bypass graft [CABG], percutaneous coronary intervention [PCI])
 - Describe basic complications for ischemic heart disease
 - Describe advantages and disadvantages of various treatment options for ischemic heart disease
 - Explain risks, benefits, and complications of treatment modalities
- ii. Ischemic Heart Disease—Patient Care and Technical Skills
 - Order basic diagnostic ECHO
 - Demonstrate basic surgical skills (simulation vs. OR)
 - Interprets diagnostic and physiologic assessment tests for routine patient with ischemic heart disease
 - Recognizes routine postoperative complications (e.g., cerebral vascular accident [CVA], shock, tamponade)
 - Assists and harvests conduits (e.g., vein mapping)
 - Performs surgical opening and closing
 - Provides basic intraoperative assisting

- iii. Cardiopulmonary Bypass, Myocardial Protection, and Temporary Circulatory Support—Medical Knowledge
- List basic components of cardiopulmonary bypass apparatus (e.g., oxygenator, pump heads, heat exchanger, low-level alarm, in-line monitoring)
 - Explain pulsatile vs. non-pulsatile and different pumps physiology
 - Describe basic myocardial protection (e.g., oxygen requirement, oxygen delivery, myocardial relaxation)
 - Explain coagulation cascade (e.g., intrinsic and extrinsic pathways) and inhibitors (e.g., heparin, warfarin, argatroban)
 - List complications of cardiopulmonary bypass (e.g., bleeding, renal failure, pulmonary dysfunction)
 - Discuss options for myocardial protection (e.g., cardioplegia vs. beating heart)
 - Discuss cannulation techniques and options for cardiopulmonary bypass (e.g., single venous, bicaval, aortic, peripheral arteries, cold, full, or partial)
 - Explains intra-aortic balloon pump physiology (e.g., diastolic augmentation and presystolic dip)
 - Performs peripheral vascular access
 - Assists perfusionists with cardiopulmonary bypass setup and pump run
- iv. Valvular Disease—Medical Knowledge
- Describe basic normal valve physiology
 - List clinical manifestations of isolated valvular heart disease (e.g., dyspnea, angina, edema, syncope)
 - List diagnostic criteria for valvular heart disease
 - List treatment options for valvular heart disease
 - Describe basic complications for valvular heart disease (e.g., perioperative complications for aortic valve replacement)
 - Describe common variations in anatomy and pathology of valvular heart disease (e.g., mitral regurgitation, types II and III)
 - Explain physiologic changes accompanying valvular heart disease (e.g., pulmonary hypertension)
 - Generate differential diagnosis of diseases with similar manifestations (e.g., coronary artery disease, emphysema)
 - Explain advantages and disadvantages of diagnostic tools in evaluating valvular heart disease (e.g., surface vs. transesophageal echo)
 - Recite risks, benefits, and complications of treatment modalities (e.g., cites frequency of common complications)
 - Order basic diagnostic and pre-operative assessment tests for valvular heart disease
 - Demonstrate basic surgical skills (simulation vs. OR)
 - Suggest treatment plan for patient with routine single valvular heart disease (e.g., single valve replacement in a symptomatic patient with aortic stenosis)
 - Recognize routine postoperative complications (e.g., identifies surgically significant bleeding)
 - Identify surgical approach for each valve

- v. Great Vessel Disease—Medical Knowledge
- Explain basic pathology of great vessels (e.g., aortic dissection classification, including spinal cord and cerebral perfusion)
 - List clinical manifestations of great vessel disease, acquired and traumatic (e.g., chest pain syndromes, Marfan's syndrome)
 - Generate differential diagnosis of diseases with similar manifestations (e.g., myocardial infarction, esophageal spasm)
 - List diagnostic tools available for the evaluation of great vessel disease
 - List treatment options for great vessel disease
 - Explain basic complications for great vessel disease (e.g., natural history, treated and untreated)
 - List advantages and disadvantages (sensitivity, specificity, negative predictive value, positive predictive value) of diagnostic tools in evaluating great vessel disease (e.g., CT scan vs. MRI vs. echocardiography vs. angiography)
 - List advantages and disadvantages of various treatment options for great vessel disease (endovascular vs. open)
 - Describe risks, benefits, and complications of treatment modalities
 - Order basic diagnostic and pre-operative assessment tests for great vessel disease (e.g., CT, echo, need for cath)
 - Obtain ATLS certification
 - Identify surgical approach
- vi. Congenital Heart Disease—Medical Knowledge
- List clinical manifestations of common congenital heart diseases (e.g., cyanosis, tachypnea, mottling, failure to thrive)
 - List diagnostic tools available for evaluating congenital heart disease (e.g., EKG, chest x-ray, echocardiogram, cardiac cath)
 - List basic congenital cardiac abnormalities (e.g., ASD, VSD, tetralogy of Fallot, transposition of great arteries)
 - List physiologic changes accompanying congenital heart disease (e.g., right to left and left to right shunt, excessive or insufficient pulmonary blood flow)
 - List basic treatment options for congenital heart disease (e.g., diuretics, digoxin, palliative vs. definitive operations)
- vii. *End Stage Cardiopulmonary Disease—Medical Knowledge
- List diagnostic tools available for evaluation of cardiac and pulmonary failure (e.g., ABG, CXR, PA line, echo)
 - Explain the natural history of cardiac and pulmonary failure (e.g., end-stage emphysema)
 - Describe basic pathology of types of cardiomyopathy
 - Explain physiologic changes accompanying cardiac and pulmonary failure (e.g., increased work of breathing hypoxemia, hypercarbia, elevated lactate, tachycardia, hypotension, reduced CO) and its differential diagnosis
 - Describe advantages and disadvantages of diagnostic tools in evaluating cardiac and pulmonary failure (e.g., cardiac-PA catheter measurements, echo vs. cath, MRI pulmonary transbronchial biopsy vs. open biopsy, advanced pulmonary stress test)

- b. *Emergency and Acute Care Management
 - Identify and respond appropriately to urgent cases
 - Demonstrate knowledge of medications used, mechanisms of action, clinically relevant pharmacokinetics, indications, contraindications, and adverse effects
- c. *Procedural Skills
 - Basic surgical skills
 - Perform diagnostic procedures
 - Wound care and dressing with understanding of wound healing
 - Chest tube insertion and removal
 - Pacer wire removal
- d. *Clinical Skills
 - Manage analgesia and sedation
 - Manage delirium
 - Manage coagulation and transfusion
 - Interpret thoracic imaging
 - Manage sepsis
 - Interpreting acid base
 - Manage fluids and electrolytes
 - Preoperative evaluation
 - Manage surgical nutrition

Competency-based learning and teaching during general surgery rotation

This rotation has a six-month duration, which must be finished during the first year of the program either continuously or interrupted according to the availability of the training slots.

The skills acquired during this rotation will include all the CanMEDS essentials, in addition to the following:

A. Knowledge

- a. The trainee will be able to:
 - Describe abdominal wall anatomy
 - Describe cancer biology
 - Interpret chest x-ray
 - Recall colon cancer
 - Describe the complications of bariatric and metabolic surgery
 - Explain the definitions and prevention of surgical infections
 - Explain delayed primary or secondary closure in contaminated wounds
 - Distinguish between gallbladder and bile duct surgery
 - Recognize homeostasis and metabolic response to injury (surgery)
 - Manage disordered and chronic wounds
 - Describe Koch's postulates
 - Differentiate liver diseases
 - Explain normal healing and how it can be adversely affected
 - Manipulate nutrition therapy and perioperative fluid management
 - Discuss the pathophysiology of shock and ischemia reperfusion injury

Recognize patterns of shock and the principles and priorities of resuscitation
Identify peptic ulcer disease
Describe the peritoneum and retroperitoneal space
Assess preoperative care including risk assessment
Recognize the principles of cancer prevention and early detection
Identify the principles of microscopic diagnosis, including the features of neoplasia
Apply the principles of therapy of surgical infections
Classify the principles underlying surgical and non-surgical treatments for cancer
Identify common surgical infections and infestations in the tropics
Examine splenomegaly and differentiate its causes
Identify stomach cancer
Explain basic principles of radiation protection
Differentiate the causes of reduced resistance to infection (host response)
Discover the characteristics of common surgical pathogens and their sensitivities
Predict sources of infection and their severity
Identify factors that determine wound infection potential
Explain indications for and choice of prophylactic antibiotics
List the basic principles of different imaging techniques
Distinguish catheter and drain usage
Explain the basic principles of palliative care
List the spectrum of commonly used antibiotics in surgery
Describe the value and limitations of tissue diagnosis
Identify the variety of scars and their treatment
Discuss tissue engineering and regenerative medicine
Summarize the benefits and risks of hemotherapy

b. *Emergency and Acute Care Management

Demonstrates knowledge of essential medications used in acute care, including indications, contraindications, and adverse effects.

Able to identify and respond appropriately to urgent cases such as:

- Acute abdomen
- Acute appendicitis
- Appropriate monitoring and end points of resuscitation
- Aseptic and antiseptic techniques
- Bleeding varices
- Cholecystitis
- Distinction between palliative care and end-of-life care
- Emergency endoscopy
- Goal-directed therapy
- Hemorrhoids
- Hepatic failure
- Hydatid disease
- Infectious emergency
- Intestinal obstruction
- Jaundice
- Malabsorption syndromes
- Metabolic emergency
- Pancreatitis

- Portal vein thrombosis
 - Suspected abuse, including the proper legal procedures
 - Tension pneumothorax
 - Clinical presentation of surgical infections
 - Management of abscesses
 - Basic principles of laparoscopic trocar insertion
 - Basic principles of patient positioning and operating room safety
 - Basic principles of skin and abdominal incisions
 - Basic principles of wound closure
- c. *Procedural Skills
- The trainee will be able to:
- Apply appropriate monitoring skills
 - Perform arterial cut-down
 - Insert arterial line
 - Apply aseptic and antiseptic techniques
 - Practice basic surgical skills (knotting and suturing)
 - Apply biopsy skills
 - Insert central line
 - Insert and remove chest tube
 - Insert and remove drains
 - Understand endoscopy basic skills
 - Establish and secure airway
 - Insert and remove Foley catheter
 - Practice gown and glove (PPE) donning and doffing
 - Apply incision and drainage vs. catheter drainage of abscesses
 - Practice intravenous access
 - Perform laparoscopic trocar insertion
 - Participate in patient positioning in operating room
 - Apply principles of patient safety in the ward and in the operating room
 - Perform diagnostic procedures.
 - Prep and drape in the operating room
 - Understand and apply scrubbing technique
 - Practice skin and abdominal incisions
 - Apply principles of tissue samples handling and processing
 - Perform venous cut-down
 - Practice wound care and dressing with understanding of wound healing
 - Perform wound closure
- d. *Clinical Skills
- The trainee will be able to:
- Apply principles of appropriate monitoring and end points of resuscitation
 - Distinguish between palliative care and end-of-life care
 - Assess and manage fluid and electrolytes
 - Organize an operating list
 - Take a patient's consent
 - Identify and optimize the patient at higher risk
 - Interpret ABG and acid–base balance
 - Manage analgesia and sedation

- Manage coagulation and transfusion
- Manage delirium
- Manage sepsis
- Assess and manage surgical nutrition
- Perform preoperative risk assessment
- Apply principles of therapy of surgical infections
- Interpret abdominal radiology
- Interpret chest x-ray
- Recognize suspected abuse
- Perform a wound healing assessment

Competency-based learning and teaching during general and cardiac surgical ICU rotations

These two rotations are of six weeks' duration each. They include rotations in general and surgical ICU during the first year of the training program.

The skills acquired during this rotation will include all the CanMEDS essentials, in addition to the following:

- a. Medical Knowledge: General
 - Explain chest x-ray
 - Recognize benefits and risks of hemotherapy
- i. Medical Knowledge—Respiratory Failure and Ventilator Events
 - Explain the basics of the diagnosis of respiratory failure
 - Describe basic knowledge of management of respiratory failure
 - Describe the basics of the diagnosis of ventilator-associated events
 - Describe the basics of techniques to prevent ventilator-associated events
 - Describe the basics of techniques to treat ventilator-associated events
- ii. Medical Knowledge—Nutritional Support
 - Describe the basics of nutritional assessment of critically ill patients
 - Describe the basics of nutritional requirements of surgical patients
- iii. Medical Knowledge—Shock/Resuscitation
 - Describe the types of shock
 - Describe the basics of resuscitation of shock
 - Explain the advanced options for treatment
- iv. Medical Knowledge—Acute Kidney Injury
 - Describe the basic knowledge of acute kidney injury
 - Identify basic knowledge of methods to manage acute kidney injury
 - Explain basic knowledge of to prevent acute kidney injury
- v. Medical Knowledge—Pathophysiology
 - Describe the pathophysiology of surgical impact
 - Explain anticipated complications in surgical patients

- vi. Medical Knowledge—Cardiac Disorders in ICU
 - Explain basics of cardiac physiology
 - Describe the basics of cardiac pathophysiology
 - Explain the basics of treatment of common cardiac disorders
- vii. Medical Knowledge—Neurologic Disorders in ICU
 - Identify basic knowledge of pathophysiology of neurologic disorders (e.g., coma, delirium, seizures)
 - Identify basic knowledge of treatment of neurologic disorders
- viii. Medical Knowledge—GI Disorders in ICU
 - Describe basic knowledge of pathophysiology and diagnosis of acute GI disorders (e.g., C. difficile colitis, GI bleeding, hepatic failure, intestinal ischemia, post-operative complications, pancreatitis)
 - Identify basic knowledge of prevention and treatment of acute GI disorders
- ix. Medical Knowledge—Infectious Diseases in ICU
 - Identify basic knowledge of pathophysiology and diagnosis of infectious diseases in surgical patients
 - Describe basic knowledge of prevention and treatment of ICU infections and infectious complications
- a. *Emergency and Acute Care Management
 Demonstrates knowledge of essential medications used in acute care, including indications, contraindications, and adverse effects.

Able to identify and respond appropriately to urgent cases such as:

- Acute infectious outbreaks, like the COVID-19 pandemic
 - Appropriate monitoring and end points of resuscitation
 - Aseptic and antiseptic invasive monitoring and intervention techniques
 - Independently recognizes and treats acute common cardiac disorders (e.g., acute myocardial infarction, dysrhythmias, heart failure, tamponade)
 - Distinction between palliative care and end-of-life care
 - Goal-directed therapy
 - Infectious emergencies
 - Metabolic and electrolyte emergencies
- b. *Procedural Skills
 The trainee will be able to:
- Apply appropriate monitoring skills
 - Apply the ACLS principles
 - Perform arterial cut-down
 - Insert arterial line
 - Apply principles of aseptic and antiseptic techniques
 - Practice basic surgical skills (knotting and suturing)
 - Insert central line
 - Practice chest tube insertion and removal
 - Practice drain insertion
 - Practice endoscopy basic skills

- Establish and secure airway
- Practice Foley catheter insertion
- Practice gown and glove (PPE) donning and doffing
- Detail the procedure in emergency ICU sternotomy and internal cardiac massage
- Practice intravenous access
- Detail the procedure in peripheral and central ECMO insertion
- Practice patient positioning for intubation and CPR
- Perform diagnostic bedside ultrasound
- Prep and drape in ICU room for sterile techniques
- Apply principles of proper scrubbing technique
- Participate in temporary pacer insertion, removal, and management
- Practice venous cut-down
- Practice wound care and dressing with understanding of wound healing
- Participate in wound and sternal closure in ICU

c. ***Clinical Skills**

The trainee will be able to:

- Practice appropriate monitoring and end points of resuscitation
- Distinguish between palliative care and end-of-life care
- Practice fluid and electrolyte assessment and management
- Take a patient's consent
- Identify the patient at higher risk
- Interpret ABG and acid–base balance
- Manage analgesia and sedation
- Manage coagulation and transfusion
- Manage delirium
- Manage postop nausea and vomiting (PONV)
- Manage sepsis
- Practice nutrition assessment and manage surgical nutrition
- Participate in risk assessment
- Read and interpret chest x-ray
- Practice wound healing assessment
- Participate in basic ventilation management (initiation, maintenance, and weaning)
- Recognize and initiate treatment of acute kidney injury
- Formulate care to prevent acute kidney injury
- Appropriately assesses patients with coma, delirium, and other neurologic disorders
- Categorize the basic treatment of coma, delirium, seizures, and stroke

Competency-based learning and teaching during trauma rotation

This rotation is of two months' duration, and will be done during the second year.

The skills acquired during this rotation will include all the CanMEDS essentials, in addition to the following.

A. Knowledge

Eliciting and documenting a good history and physical examination (comprehensive, accurate, concise with relevant details).

Identifying the appropriate testing needed to develop a comprehensive diagnostic and treatment plan (e.g., diagnostic tests used in a cost-effective manner, with an understanding of their limitations and predictive value)

Formulating an appropriate differential diagnosis.

Analyzing, integrating, and formulating effective management strategies.

i. Medical Knowledge: General

The trainee will be able to:

- Read and interpret a chest x-ray
- Describe the benefits and risks of hemotherapy
- Identify the basic knowledge of the pathophysiology of severely injured patients
- Describe the basic knowledge of anticipated complications in severely injured patients (e.g., brain injury, flailing chest, compartment syndromes, rhabdomyolysis, coagulopathy, wound management)
- Prioritize treatment of the multiply injured patient
- Practice initial assessment and management
- Participate in triage
- Perform resuscitation
- Perform airway management
- Detail the procedure in the management of oxygenation
- Detail the procedure in the management of ventilation
- Explain shock pathophysiology
- Explain hemorrhagic shock
- Participate in the initial management of hemorrhagic shock
- Evaluate fluid resuscitation and organ perfusion
- Participate in blood replacement
- Detail the procedure in resuscitative thoracotomy
- Differentiate the indications for laparotomy in adults
- Identify the classifications of head injuries
- Recognize brain death
- Distinguish classifications of spinal cord injuries
- Explain transfer responsibilities 302 and transfer protocols

ii. Medical Knowledge—Respiratory Failure and Ventilator Events

- Identify the basic knowledge of the diagnosis of respiratory failure
- Identify the basic knowledge of management of respiratory failure

iii. Medical Knowledge—Nutritional Support

- Recognize the basic knowledge of nutritional assessment of critically ill patients
- Recognize the basic knowledge of nutritional requirements of surgical patients

iv. Medical Knowledge—Shock/Resuscitation

- Describe the basic knowledge of the types of shock
- Appraise the basic knowledge of resuscitation of shock
- Describe the advanced knowledge of appropriate options for treatment

- v. Medical Knowledge—Acute Kidney Injury
 - Explain the basic knowledge of acute kidney injury
 - Discriminate between the methods to manage acute kidney injury
 - Apply the basic knowledge of to prevent acute kidney injury
- vi. Medical Knowledge—Pathophysiology
 - Describe the pathophysiology of surgical impact
 - Discuss the anticipated complications in surgical patients
- B. *Emergency and Acute Care Management
Demonstrates knowledge of essential medications used in acute trauma care, including indications, contraindications, and adverse effects.

Trainees must be able to identify and respond appropriately to urgent cases such as:

- Acute infectious outbreaks like COVID-19 pandemic
 - Appropriate monitoring and end points of resuscitation
 - Aseptic and antiseptic invasive monitoring and intervention techniques
 - Acute common cardiac disorders (e.g., acute myocardial infarction, dysrhythmias, heart failure, tamponade)
 - Distinguishing between palliative care and end-of-life care
 - Goal-directed therapy
 - Infectious emergencies
 - Metabolic and electrolyte emergency
 - Basic major disaster and triage management
- C. *Procedural Skills
The trainee will be able to:
- Perform abscess incision and drainage
 - Apply the principles of advanced cardiac life support (ATLS)
 - Apply aseptic and antiseptic techniques
 - Practice basic surgical skills (knotting and suturing)
 - Perform central line placement
 - Perform chest tube insertion and removal
 - Practice Foley catheter insertion
 - Apply emergency scrubbing technique
 - Detail the procedure in emergency thoracotomy and internal cardiac massage
 - Perform intravenous access
 - Participate in peripheral and central ECMO insertion
 - Perform venous cut-down
 - Practice wound care and dressing with an understanding of wound healing
 - Practice wound closure
 - Participate in initial assessment and management
 - Perform oropharyngeal airway insertion
 - Perform nasopharyngeal airway insertion
 - Participate in bag-mask ventilation: two-person technique
 - Perform adult orotracheal intubation
 - Manipulate laryngeal mask airway (LMA)
 - Use pulse oximetry monitoring

- Use carbon dioxide detection
- Practice needle cricothyroidotomy
- Practice surgical cricothyroidotomy
- Perform peripheral venous access
- Perform femoral venipuncture: Seldinger technique
- Perform subclavian venipuncture: infraclavicular approach
- Perform internal jugular venipuncture: middle or central route
- Practice intraosseous puncture/infusion: proximal tibial route
- Identify pelvic fractures: apply pelvic binder
- Practice venous cutdown
- Demonstrate process for initial review of chest x-rays
- Perform needle thoracentesis
- Perform chest tube insertion
- Practice pericardiocentesis (optional)
- Practice focused assessment sonography in trauma (fast)
- Participate in diagnostic peritoneal lavage—open technique
- Participate in diagnostic peritoneal lavage—closed technique
- Demonstrate cervical spine x-ray assessment
- Apply treatment principles for patients with spinal cord injuries
- Show principles of spine immobilization and logrolling
- Assess and manage compartment syndrome
- Identify arterial injury

D. *Clinical Skills

Apply appropriate monitoring and analyze end points of resuscitation
 Distinguish between palliative care and end-of-life care
 Assess and manage fluid and electrolytes administration
 Take a patient's consent
 Identify the patient at a higher risk
 Interpret ABG and acid–base balance
 Participate in emergency resuscitation
 Manage emergency transfusion

Competency-based learning and teaching during thoracic surgery rotation

Thoracic surgery rotations will be divided into two parts, each two months long, both will be during the junior years (Years 1–5, one during **Junior Residency in General Cardiac surgery and one during Junior Residency in *Specialty* Cardiac Surgery**).

All CanMEDS principles will be applied for both parts. However, the set of skills is expected to be different and progressive from each rotation.

This description applies to both. The program director will arrange with the trainee and the attending in thoracic surgery about the required skills for each stage.

A. Knowledge

i. Medical Knowledge: General

By the end of this rotation, the trainee will be able to:

- Read and interpret chest x-ray
- Understand the benefits and risks of hemotherapy

ii. Basic Knowledge

- Describe pulmonary physiology, and ventilation and gas exchange
- Describe the anatomy of tracheobronchial tree and lungs anatomy, thoracic inlet, neck and mediastinum, chest wall, and diaphragm
- Differentiate the pathology of ARDS, emphysema, and pulmonary fibrosis
- Explain the pharmacology of bronchodilators, H₂ antagonists, and proton pump inhibitors
- Recognize the microbiology of organisms involved in respiratory infection including TB 3
- Describe the management of intra pleural sepsis

iii. Thoracic Incisions Knowledge

- Identify lateral, anterior, muscle sparing and video-assisted approaches and sternotomy
- Recognize early and late complications of thoracic incisions
- Describe analgesia including pharmacology, effectiveness, and side effects
- Explain post-operative analgesia, including epidural, PCAs, and paravertebral catheter techniques
- Identify rigid and flexible bronchoscopy, and airway and ventilatory management during bronchoscopy
- Explain mediastinal exploration
- Describe endoscopic, radiological, and surgical approaches to evaluate and diagnose mediastinal disease
- Interpret hematology and biochemical investigations, chest radiograph and ECG 2 CT, including contrast enhanced CT imaging of the mediastinum. Two MRI and PET, respiratory function tests, ventilation/perfusion scan, blood gases

iv. Clinical Knowledge

- Recognize the treatment of broncho-pleural fistula
- Describes the anatomy and physiology of the pleura
- Explain and recognize pneumothorax, pleural effusion, hemothorax, and chylothorax
- Discriminate between advanced techniques for pleural space obliteration such as thoracoplasty and soft tissue transfer
- Describe pectus deformities: etiology, physiology, and surgical options for correction
- Classify and understand resection of the sternum and chest wall, physiological and cosmetic sequelae
- Identify the prosthetic materials used in chest wall surgery
- Describe the anatomy and physiology of the diaphragm.
- Recognize the pathology of the diaphragm
- Explain the clinical, physiological, and imaging techniques in the assessment of diaphragmatic abnormalities
- Describe the etiology, pathology, and physiology of COPD

- Distinguish between smoking cessation measures
 - Identify lung volume reduction surgery: techniques, complications, and management of complications
 - Explain procedures to deal with secondary pneumothorax and bullae by open techniques
 - Explain procedures to deal with secondary pneumothorax and bullae by vats techniques
- B. *Procedural Skills:
- Apply aseptic and antiseptic techniques
 - Practice basic surgical skills (knotting and suturing)
 - Perform chest tube insertion and removal
 - Perform drain insertion
 - Use endoscopy basic skills
 - Practice gown and glove (PPE) donning and doffing
 - Perform diagnostic bedside ultrasound
 - Prep and drape in the operating room
 - Discriminate scrubbing technique
 - Detail the procedure used in tracheostomy
 - Perform fiberoptic bronchoscopy
 - Participate in correct positioning of patient for thoracic surgery
 - Perform and repair thoracic incisions, including lateral, anterior, muscle-sparing, and vats incisions
 - Resect and repair the diaphragm and adjacent structures
 - Participate in lung volume reduction surgery using open and vats techniques
- C. *Clinical Skills
- Interpret ABG and acid–base balance
 - Manage analgesia and sedation
 - Manage coagulation and transfusion
 - Recognize esophageal function tests and contrast studies
 - Apply risk assessment, stratification, and management
 - Practice post-operative management of respiratory failure, sputum retention
 - Assist in physiotherapy and rehabilitation

Competency-based learning and teaching during vascular rotation

Vascular surgery rotations will be divided into two parts, each two months long, both will be during the junior years (Years 1–5, one during **Junior Residency in General Cardiac surgery and one during Junior Residency in *Specialty Cardiac Surgery***).

All CanMEDS principles will be applied for both parts. However, the set of skills is expected to be different and progressive from each rotation.

This description is applicable to both. The program director will arrange with the trainee and the attending in vascular surgery about the required skills for each stage.

The skills acquired during this rotation will include all the CanMEDS essentials in addition to the following:

A. Knowledge

i. Medical Knowledge: General

The trainee will be able to:

- Read and interpret a chest x-ray
- Describes the benefits and risks of hemotherapy
- Recognize vascular anatomy and physiology
- Describe hemodynamic physiology and measurement
- Describe rheology and arterial pressure regulation
- Describe blood supply of the spinal cord
- Summarize the pathology of atheroma, medial necrosis, arthritis, inherited disorders of vascular biology
- List the drugs used in the treatment of hypertension
- Classify antiplatelet, anticoagulant, and thrombolytic drugs
- Describe the natural history of aortic disease
- Recognize the diagnosis, investigation, and assessment of aortic disease
- Describe spinal cord and cerebral preservation strategies
- Recognize both Type A dissection and Type B dissection.
- Identify thoraco-abdominal aneurysm
- Describe non-surgical management including the role of endovascular stenting
- Discriminate vascular grafts and vascular instruments

B. *Procedural Skills:

- Perform arterial cut-down
- Perform arterial line placement
- Apply aseptic and antiseptic techniques
- Practice basic surgical skills (knotting and suturing)
- Perform central line placement
- Practice gown and glove (PPE) donning and doffing
- Perform intravenous access
- Perform diagnostic bedside doppler ultrasound
- Prep and drape in the operating room
- Describe and practice scrubbing technique
- Perform venous cut-down
- Detail the procedure used in femoral cannulation and axillary cannulation
- Participate in surgery for acute dissection of the ascending aorta
- Perform vascular anastomosis

C. *Clinical Skills

Identify patients at higher risk
Manage coagulation and transfusion
Interpret vascular imaging

Competency-based learning and teaching during cardiology-CCU rotation

This rotation is of two months' duration during the **Junior Residency in General Cardiac surgery** years. The main objective is to allow the trainee to be familiar with cardiology/CCU patients and the essential skills required for management according to CanMEDS standards, in addition to the following:

A. Knowledge

The trainee will be able to:

- i. Medical Knowledge: General
 - Read and interpret chest x-ray
 - Understand hemodynamic monitoring
 - ii. Medical Knowledge—Shock/Resuscitation
 - Discriminate between the types of shock
 - Describe resuscitation of shock
 - Recognize the advanced options for treatment of shock
 - iii. Medical Knowledge—Acute Kidney Injury
 - Describe the basic knowledge of acute kidney injury
 - Discriminate the basic methods to manage acute kidney injury
 - Explain basic knowledge to prevent acute kidney injury
 - iv. Medical Knowledge—Pathophysiology
 - Describe the pathophysiology of heart failure
 - Explain the pathophysiology of ischemic heart disease
- B. *Emergency and Acute Care Management
- Demonstrate knowledge of essential medications used in acute care, including indications, contraindications, and adverse effects.

Able to identify and respond appropriately to urgent cases such as:

- Apply appropriate monitoring and end points of resuscitation
 - Apply aseptic and antiseptic invasive monitoring and intervention techniques
 - Recognize independently and treat acute common cardiac disorders (e.g., acute myocardial infarction, dysrhythmias, heart failure, tamponade) and its complications
 - Distinguish between palliative care and end-of-life care
 - Recognize goal-directed therapy
 - Practice electrolytes emergency
- C. *Procedural Skills
- Apply appropriate monitoring skills
 - Apply the principles of advanced cardiac life support (ACLS)
 - Perform arterial cut-down
 - Perform arterial line placement
 - Apply aseptic and antiseptic techniques
 - Perform central line placement
 - Perform temporary pacemaker insertion and removal
 - Detail the procedure used in pericardiocentesis and drains insertion

- Participate in IABP insertion and management
- Practice TEE and TTE basic skills
- Perform intravenous access
- Participate in peripheral and central ECMO insertion
- Assist in patient positioning for intubation and CPR
- Prep and drape for aseptic techniques
- Perform venous cut-down

D. *Clinical Skills

The trainee will be able to:

- Apply appropriate monitoring and end points of resuscitation
- Distinguish between palliative care and end-of-life care
- Practice fluid and electrolyte assessment and management
- Take a patient's consent
- Identify patient at higher risk
- Interpret ABG and acid–base balance
- Manage analgesia and sedation
- Manage coagulation and transfusion
- Manage IABP
- Manage ventricular assist devices

Competency-based learning and teaching during cardiac catheterization rotation

This rotation has a two-month duration during the **Junior Residency in General Cardiac surgery** years. The main objective is to expose the trainee for the required skills in the Cath Lab and to sharpen skills both diagnostic and therapeutic. All CanMEDS principles will be applied in addition to the following:

A. Knowledge

i. Medical Knowledge: General

The trainee will be able to:

- Interpret catheterization images
- Recognize the indications for cardiac catheterization
- Describe TAVI
- Discriminate anticipated complications

ii. Medical Knowledge—Acute Kidney Injury

- Describe basic knowledge of acute kidney injury
- Recognize methods to manage acute kidney injury
- Identify basic knowledge to prevent acute kidney injury

B. *Emergency and Acute Care Management

The trainee will be able to:

Demonstrate knowledge of essential medications used in acute care, including indications, contraindications, and adverse effects.

Identify and respond appropriately to urgent cases such as:

- Acute infectious outbreaks like the COVID-19 pandemic
- Appropriate monitoring and end points of resuscitation
- Aseptic and antiseptic invasive monitoring and intervention techniques
- Independently recognizes and treats acute common cardiac disorders (e.g., acute myocardial infarction, dysrhythmias, heart failure, tamponade)

C. *Procedural Skills

- Apply appropriate monitoring skills
- Apply the principles of advanced cardiac life support (ACLS)
- Perform arterial cut-down
- Perform arterial line placement
- Apply aseptic and antiseptic techniques
- Practice basic surgical skills (knotting and suturing)
- Perform central line placement
- Perform drains insertion
- Practice gown and glove (PPE) donning and doffing
- Perform intravenous access
- Take part in peripheral and central ECMO insertion
- Prep and drape the cath lab
- Describe the scrubbing technique
- Perform venous cut-down
- Practice pacemaker insertion

D. *Clinical Skills

- The trainee will be able to:
- Apply appropriate monitoring and end points of resuscitation
- Practice fluid and electrolyte assessment and management
- Take a patient's consent
- Identify patients at higher risk

Competency-based learning and teaching during echocardiography rotation

This rotation has one-month duration in the non-invasive cardiology lab for learning all the fundamentals of echocardiography during the **Junior Residency in General Cardiac surgery** years. All CanMEDS principles will be applied, in addition to the following.

Knowledge

- b. Medical Knowledge: General
 - Describe the basic knowledge of echocardiography
- i. Medical Knowledge—Cardiac Echo
 - Describe basic knowledge of cardiac physiology
 - Recognize basic knowledge of cardiac pathophysiology
 - Explain stress Echo
 - Describe and measure hemodynamic assessment
 - Describe and participate in valve assessment

- ii. Medical Knowledge—
 - Manage conscious sedation
- d. *Procedural Skills
 - 1) Apply appropriate monitoring skills
 - 2) Perform TTE and TEE
- e. *Clinical Reading Skills

The trainee will be able to describe and identify the knowledge related to:

 - 1) Mitral valve disease
 - 2) Aortic valve disease
 - 3) Tricuspid valve disease
 - 4) Ischemic heart disease
 - 5) LV dysfunction
 - 6) Adult with CHD

Competency-based learning and teaching during cardiac anesthesia rotations

This rotation is for a one-month duration in operating rooms for cardiac surgery anesthesia. It must be during the **Junior Residency in General Cardiac surgery** years (Years 1–3) for the fundamentals of cardiac anesthesia. All CanMEDS principles will be applied, in addition to the following.

1) Medical Knowledge General

The trainee will be able to:

- Recognize the pharmacology of anesthesia, analgesia, and sedation
 - Define and describe airway
 - Describe the benefits and risks of hemotherapy
 - Recognize the anticipated complications in surgical patients
 - Describe the methods of resuscitation of shock
 - Identify basic knowledge of treatment of common complications
 - Recognize prevention and treatment of infectious complications
- 2) *Emergency and Acute Care Management
- Demonstrate knowledge of the essential medications used in acute care, including indications, contraindications, and adverse effects.
- Be able to identify and respond appropriately to urgent cases such as:
- Acute infectious outbreaks like the COVID-19 pandemic
 - Appropriate monitoring and end points of resuscitation
 - Aseptic and antiseptic invasive monitoring and intervention techniques
 - Independently recognize and treat acute disorders (e.g., acute myocardial infarction, dysrhythmias, malignant hyperthermia, tamponade)
 - Metabolic and electrolyte emergencies
3. *Procedural Skills
- Apply appropriate monitoring skills
 - Apply the principles of advanced cardiac life support (ACLS)
 - Perform arterial line placement

- Apply aseptic and antiseptic techniques
 - Perform central line placement
 - Demonstrate endoscopy basic skills
 - Establish and secure airway
 - Practice gown and glove (PPE) donning and doffing
 - Perform intravenous access
 - Participate in patient positioning
 - Discriminate utilization of vascular ultrasound
 - Prep and drape in or room for sterile techniques
 - Participate in temporary pacer insertion, removal, and management
4. *Clinical Skills
- Apply appropriate monitoring and end points of resuscitation
 - Distinguish between palliative care and end-of-life care
 - Practice fluid and electrolytes assessment and management
 - Take a patient's consent
 - Identify patient at higher risk
 - Interpret ABG and acid–base balance
 - Manage analgesia and sedation
 - Manage coagulation and transfusion
 - Practice basic ventilation management (initiation, maintenance, and weaning)

Competency-based learning and teaching during research rotation

Rotation rationale:

In designing the research rotation curriculum, we elected to follow the 2020 recommendations proposed to the SCFHS by the research and EBM task force, from which we select the following:

1. Evidence-eased practice modules should be mandatory for all residency and fellowship training programs.
2. A minimum research methodology competency should be mandatory in all residency and fellowship programs.
3. Advanced research methodology competencies should be optional for residency programs; however, residents who are interested in acquiring such skills should be given the time for and access to such a training (e.g., by attending a formal research course organized by one of the research centers in Saudi Arabia; here we also permitted program directors to suggest some of the international, high-caliber online courses)
4. A research project should be mandatory for all residency and fellowship programs. These projects need to be presented by the trainee and evaluated by the training program. Such research projects may cover:
 - An evidence-based literature review
 - A clinical audit
 - A research project
5. The mandatory evidence-based module and the mandatory research module should be covered over 2–4 weeks (these fit easily within the allotted rotation time span).

6. If the trainee wants to go for a research project which requires an IRB approval, four weeks should be allocated for the research project (it can be taken as an elective rotation, but this item is not elective in our program, and these fit easily within the allotted rotation time span).
7. There is a need to establish a fellowship in clinical research, or clinician investigator fellowship to cover the shortage of healthcare professionals who are trained in the field of research (this item may be introduced in future updates of the curriculum).

Objectives:

By the end of all the research rotations, residents will be able to:

- Describe the principles and clinical implications of evidence-based medicine (EBM)
- List the fundamentals of research types and research methodology
- Critically appraise and evaluate research articles/projects/ presentations.
- Extrapolate results from research articles and apply them to clinical practice

The allotted time span for the research rotation is six months in total, to be divided into two months' rotation in R1, R2, and R3 each. During this rotation, the resident is expected to continue to take night calls or cardiac surgery ICU calls average of 6–7 nights per month. Good visibility in the operating rooms as a non-obligatory presence to observe different kinds of cardiac surgery in the operating rooms is highly recommended and anticipated, but without being assigned to assist. The trainee is required to submit a full research proposal/manuscript by the end of R3. The resident should attend courses online early on the R1 rotation on evidence-based medicine and clinical research. The following are some good examples, and it is up to the program director to mandate any of them:

<https://www.coursera.org/learn/clinical-research>

<https://www.coursera.org/learn/clinical-data-management?aid=trueandauthMode=login>

<https://www.coursera.org/learn/statistical-inferences>

<https://www.coursera.org/learn/mindware>

<https://www.edx.org/course/introduction-to-applied-biostatistics-statistics-f>

Research supervisors:

- The supervisor is a facilitator for this resident-based activity. He/she should have sufficient clinical experience to implement research information or publications and EBM principles in the day-to-day practice of cardiac surgery (preferably have published papers in peer-reviewed journals).
- The program director or his/her delegated consultant will be the supervisor for a resident. Residents can suggest mentors to the program director who will finalize the assignments, ensuring fair distribution.
- Performance of the resident and the supervisor will be reviewed with feedback assessments in the One45 program at end of the rotation.
- The supervisor is responsible for the following:
 - Guiding the resident to obtain the necessary institutional approval
 - Reviewing and approving the research proposal and timeline made by the resident
 - Regularly weekly supervising residents according to the timeline
 - Documenting all supervision sessions in the research progress form (see Appendix)

- Reporting all supervision sessions to research resident program committee (RPC)
- Reviewing and approving the final copy of the proposal and manuscript
- Signing the research submission letter stating that the research was conducted under his/her supervision and guidance
- Participating in the evaluation of proposals and research papers submitted to the research committee, if required
- Attend and support the annual research day

Role of the Resident

The resident is responsible for preparing and conducting research within the time frame specified by the program and for following up with his/her supervisor and departmental research unit. He/she should report any difficulties encountered to the program director or his/her deputy.

- Selecting the research topic: Select a research topic with the guidance of his/her supervisor
- Proposal: Prepare, finalize, and submit the proposal to his/her supervisor for approval
- Conducting research and writing the manuscript: Conduct the fieldwork (data collection, data entry, etc.); perform all other research tasks (data entry, analysis, and manuscript writing) with the help and guidance of his/her supervisor/research unit; submit the final draft of the research on time

Topic Selection

In selecting a topic for research, the research committee, supervisors, and residents should consider the following important points (FINER):

- F—Feasible. Is the question answerable? Do you have access to all the materials you will need to do the study? Do you have access to enough subjects? Will you have enough time and money? Do you have the expertise to do this study, or can you collaborate with someone who does?
- I—Interesting. The question must be interesting to the investigator, but it should also be interesting to others.
- N—Novel. Has this study been performed before? Does it add to the current body of medical knowledge?
- E—Ethical. Can the study be performed in a way that does not subject subjects to excess risks? Will IRB approve the study?
- R—Relevant. Will it further medical science? Will the results change clinical practice or health policy or point towards further avenues of research?

Example of Fields of Research:

1. Basic cardiac science
2. Cardiopulmonary bypass
3. Myocardial protection
4. Ischemic heart disease
5. Mitral valve surgery and pathology
6. Aortic valve surgery
7. TAVI
8. Heart valves
9. Mechanical circulatory support

10. ECMO
11. Congenital heart diseases
12. Aortic dissection and aneurysm
13. New technologies
14. Other aspects of cardiac surgery

Joint Research

Joint research (more than one resident) should be encouraged and can be conducted under the following conditions (after approval from the research committee):

- Large national research projects
- Projects spanning multiple sectors and or different regions in the Kingdom of Saudi Arabia
- Meta-analysis or systematic review

Process of Writing

- The research paper should be written and edited properly in English with no grammar or spelling mistakes, with an abstract in both Arabic and English (abstract should not exceed 200 words).
- The cover page should include the following:
 - Name of the training program
 - Title of the research
 - Name of the researchers
 - Date of research submission
 - The name of the supervisor
- Style should be consistent with an international standard, e.g., the style adopted by the American Medical Association (AMA)

Competency-based learning and teaching during the research rotation

Expected competencies in these rotations (Research-R1 Rotation, Research-R2 Rotation, Research-R3 Rotation) are described in the basic template, in addition to the following.

Theme 1

Acquire and integrate the best available evidence in providing optimal patient care

Learning Objective 1.1

Implement evidence related to therapy, diagnosis prognosis, and systematic reviews into clinical decision making

Knowledge

- a. Describe clinical uncertainty in clinical decision-making
- b. Describe the concept of EBM and the interactions between research evidence, clinical expertise, and patient values and preferences
- c. Describe the impact of study design on the validity and implementation of study results
- d. Describe the quality of evidence based on methodological rigors

Skills

- Use the best available evidence to inform decision-making whenever possible
- Rank evidence according to its validity and consistency
- Make decisions based on clinical judgment and patient's preferences when evidence is lacking or conflicting
- Integrate patients' preferences and values in the implementation of evidence

Learning Objective 1.2

Search, appraise and apply information from primary and secondary sources of evidence

Knowledge

- Differentiate between patient-oriented evidence outcomes and disease-oriented outcomes
- Lists the five steps in the application of EBP
- Describe the primary and secondary sources of evidence of evidence
- Explain the different types of study design and their role in answering different types of clinical questions including randomized clinical trials, cohort studies, case-control studies, systematic reviews, and clinical guidelines
- Describe principles of critical appraisal including principles related to the validity, results, and applicability of different study designs

Skills

- Formulate clinical search question relevant to patients' care
- To demonstrate efficiency in searching primary and secondary databases to retrieve relevant evidence
- Interpret and calculate important concepts related to therapy, including relative risk, odds ratios, hazards ratio, absolute risk reduction, number needed to treat, number needed to harm, and 95% confidence intervals
- Interpret and calculate important concepts related to diagnosis, including sensitivity, specificity, and likelihood ratios
- Interpret the role of prognostic factors in predicting outcomes, and interpret the hazards ratio (HR) of prognostic factors
- Understanding the components of a forest plot
- Understand and interpret the concept of heterogeneity the forest plot and the funnel plot
- Present relevant evidence-based data to patients and their caregivers in a presentation they can understand.

Theme 2

Acquire the skills of conducting and presenting research

Learning Objective 2.1

Describe basic principles of research in healthcare

Knowledge

- Define health research and understand its impact on the individual patients and healthcare systems

- Differentiate between utilization of research and the conduction of research
- Describe the steps of conducting health research, including:
- Identify criteria for choosing/generating ideas and topics for research, including:
 - Relevance
 - Originality
 - Feasibility
 - Conduct a literature review
 - Design the methodology
 - Write the research proposal
 - Obtain the institutional review board (IRB) approval
 - Collect the data
 - Analyze the data
 - Write the manuscript
- Describe the different types of study design, including:
 - Descriptive studies
 - Case report
 - Cross sectional
 - Observational analytical studies
 - Case-control
 - Cohort
 - Prospective
 - Retrospective
 - Intervention studies
 - Experimental
 - Randomized
 - Non-randomized

Skills

- Identify opportunities
- Formulate research questions
- Conduct a literature review
- Choose the right study design to answer the research question

Learning Objective 2.2

Acquire advanced principles of research design in healthcare

Knowledge

- Describe the difference between primary and secondary objectives of research.
- Describe the different types of variables.
- Describe the different methods of sampling
- Describe the importance of sample size calculation.
- Describe the importance of data collection tools.

Skills

- Define the primary objectives (main, the basis of sample size calculation) and secondary objectives of research.
- Define variables and state the difference between numerical and categorical variables.
 - Categorical (qualitative)
 - Nominal
 - Ordinal
 - Numerical (quantitative)
 - Discrete
 - Continuous
- Select the appropriate method of sampling.
- Calculate the study sample size
- Design a data collection tool appropriate for the study design.

Learning Objective 2.3

Acquire advanced skills of data processing and analysis

Knowledge:

Lists the components of data entry

Skills:

- Enter data, using one of the programs for data entry.
- Choose appropriate statistical tests for different sets of data:
 - Chi-square test (categorical variables)
 - T-test (continuous variables)
 - Pearson correlation (continuous variables)
 - Spearman correlation (continuous and categorical variables)
 - Linear regression (continuous variables)
 - Survival analysis.

Learning Objective 2.4

Communicate research findings

Knowledge

- Recognize the importance of publishing clinical research.
- Describe the most common structure of manuscript writing (Introduction, Methods, Results, Discussion)

Skills

- a. Prepare a research poster to be presented in scientific meetings
- b. Write the final manuscripts for thesis defense and publication

Learning Objective 2.5

Understand principles of research ethics

Knowledge

- a. Identify the four universal principles of research ethics:
 - a. Autonomy
 - b. Beneficence
 - c. Non-maleficence
 - d. Justice
- b. Outline the requirements for informed consent
- c. Identify the process to protect privacy of individuals and confidentiality of data
- d. Describe the process of IRB approval

Skills

- a. Assess risk and benefits for the study participants
- b. Write an informed consent for the research project, if indicated
- c. Ensure the confidentiality of data
- d. Complete a national or international Protecting Human Research Participants (PHRP) online Training module
- e. Obtain an IRB approval for the research project

Selected Resources for EBM and Research

Books:

Guyatt G, Rennie D, Meade M, Cook D, editors. Users' guides to the medical literature: A manual for evidence-based clinical practice. Chicago: AMA press; 2002 Feb 1.
Straus SE, Glasziou P, Richardson WS, Haynes RB. Evidence-based medicine e-book: How to practice and teach EBM. Elsevier Health Sciences; 2018 Feb 27.
Hulley SB, editor. Designing clinical research. Lippincott Williams & Wilkins; 2007.

Tools:

Critical Appraisal Sheets (Centre for Evidence-Based Medicine, Oxford)
<https://www.cebm.net/2014/06/critical-appraisal/>
OpenEpi (free online statistical calculator) https://www.openepi.com/Menu/OE_Menu.htm

Appraised Sources

BMJ Best Practice (accessible through Saudi Digital Library) <https://bestpractice.bmj.com/info/>

Evidence Alerts (a service from McMaster University that notifies you about newly published clinical studies)
<https://www.evidencealerts.com/>

Daily POEMs

<https://www.essentialevidenceplus.com/content/poems>

Evidence-Based Guidelines: Agency for Health Care Research and Quality (AHRQ)
<http://www.ahrq.gov/clinic/prevenix.htm>

The National Institute for Health and Clinical Excellence
<http://www.nice.org.uk/>

Competency-based learning and teaching during adult cardiac surgery rotation

This rotation is a core rotation, representing the main bulk of training in this program. The total duration is 32 months distributed over four years (the **Junior Residency in Specialty Cardiac Surgery and Senior Residency in Specialty Cardiac Surgery**; eight months in R4, six months in R5, twelve months in R6, and six months in R7).

All principles of CanMEDS and EPAs will be strictly applied during these years, in addition to the following:

- Ischemic heart disease
 - Knowledge: ischemic heart disease
 1. Describe the complex anatomy and pathology and natural history of coronary artery disease
 2. Identify various clinical manifestations of ischemic heart disease.
 3. Interpret normal and abnormal data associated with ischemic heart disease (e.g., read coronary angiogram, EKG, ECHO, and related lab results)
 4. Identifies appropriate treatment for ischemic heart disease and its complications (e.g., post infarct ventricular septal rupture, ischemic mitral regurgitation) and the role of treatment on the natural course of the disease
 5. Be familiar with pertinent guidelines
 6. Describe outcomes for all treatment modalities and complications, including international databases and clinical trials
 7. Describe basic outcome literature for ischemic heart disease (e.g., the SYNTAX trial and the implications of the SYNTAX score)
 8. Present outcomes of ischemic heart disease at local, regional, or national meeting
 - Clinical skills: ischemic heart disease
 1. Establish a diagnostic and assessment plan for patients with ischemic heart disease (e.g., the role of functional testing in ischemic heart disease)
 2. Manage postoperative complications (e.g., return to the OR vs. return to the cath lab, the need for ECMO or a ventricular assist)
 3. Select ideal treatment option for patient with ischemic heart disease (e.g., institute treatment per ACC/STS/AATS guidelines)
 4. Institute and wean patient from cardiopulmonary bypass
 5. Perform proximal and distal anastomosis for CABG
 6. Manage complex coronary disease (e.g., redo CABG, ventricular septal rupture, ischemic mitral regurgitation [MR], off-pump; combined coronary and carotid disease)
 7. Perform reoperative coronary bypass grafting
 8. Perform coronary endarterectomy

- Cardiopulmonary bypass, myocardial protection, and temporary circulatory support
 - Medical knowledge
 1. Demonstrate knowledge of cardioplegia solutions and delivery modes
 2. Demonstrate knowledge of acid–base management on cardiopulmonary bypass (e.g., pH stat, alpha stat)
 3. Demonstrate knowledge of anticoagulation management on cardiopulmonary bypass
 4. Demonstrate knowledge of pharmacologic management of hemodynamic
 5. Discriminate between the advantages and disadvantages of different myocardial protection strategies
 6. Recognize complications related to cardiopulmonary bypass
 7. Describe advanced cardiopulmonary support (e.g., intra-aortic balloon pump [IABP], circulatory arrest, or extracorporeal membrane oxygenation [ECMO])
 - CPB skills
 - Cannulate and institute cardiopulmonary bypass, including myocardial protection
 - Manage cardiopulmonary bypass and myocardial protection
 - Wean and decannulate from cardiopulmonary bypass
 - Recognize and manage acute complications
 - Institutes temporary circulatory support for cardiogenic shock (e.g., intraaortic balloon pump, ECMO, short term left ventricular [LV] assist)
 - Operates in a hostile chest (e.g., radiation, porcelain aorta, use of epiaortic probe, patent grafts)
 - Performs left ventricular assist device procedures or transplant
- Valvular disease
 - Medical knowledge
 - Discriminate between complex variations and integrations between anatomy and pathology of valvular heart disease
 - Identify the common variants of the clinical manifestations of valvular heart disease
 - Interpret normal and abnormal data associated with valvular heart disease, including intra-operative transesophageal echocardiography
 - Identify appropriate treatment for routine patient with valvular heart disease
 - Explain the role of treatment on physiology of valvular heart disease, including arrhythmia management
 - Be familiar with international guidelines
 - Identify basic outcome literature for valvular heart disease (e.g., durability of mitral valve repair or replacement)
 - Identify appropriate treatment for complex complicated valvular heart disease
 - Explain outcomes for all treatment modalities and complications, including databases and clinical trials
 - Present outcomes on valvular heart disease at local, regional, or national meeting
 - Valvular disease—patient care and technical skills
 - Provide a diagnostic and assessment plan for patients with valvular heart disease
 - Select ideal treatment option for patient with acquired valvular heart disease
 - Manage potential postoperative complications
 - Institute and weans patient from cardiopulmonary bypass
 - Perform optimal myocardial protection strategy
 - Perform valvular repair and replacement

- Manage complex postoperative complications, including arrhythmias (e.g., management of paravalvular leak or systolic anterior motion [SAM])
- Select ideal plan for a patient with prior transcatheter valve, minimally invasive valve
- Participate in minimally invasive, percutaneous, or robotic approaches to valvular heart disease
- Participate in atrial and ventricular arrhythmia surgery
- Participate in reconstruction of fibrous trigone in patient with endocarditis of mitral and aortic valves
- Great vessel disease
 - Medical knowledge
 - Describe the integrations between anatomy and pathology of great vessel disease.
 - Identify the clinical manifestations of great vessel disease, (e.g., malperfusion; bowel ischemia, renal insufficiency)
 - Interpret normal and common data abnormalities associated with great vessel disease (e.g., sensitivity, specificity, accuracy of aortic imaging techniques)
 - Identify appropriate and/or adjunct treatment for great vessel disease (neuroprotection, spinal cord protection, renal)
 - Describe basic outcome literature for great vessel disease
 - Describe complex variations in anatomy and pathology of great vessel disease, acquired, congenital, and traumatic (e.g., congenital arch anomalies leading to tracheal or esophageal compression)
 - Distinguish between the complex clinical manifestations and complications of great vessel disease, acquired, congenital, and traumatic (e.g., myocardial infarction vs. acute aortic dissection)
 - Interpret and integrate complex abnormalities associated with great vessel disease (e.g., aneurysm, dissection, pseudo-aneurysm, penetrating ulcer)
 - Identify appropriate treatment for complex patient with great vessel disease (e.g., cardiopulmonary bypass [CPB] techniques)
 - Describe outcomes for all treatment modalities and complications, including databases and clinical trials
 - Describe acute and chronic pulmonary thromboembolic disease
 - Great vessel disease—patient care and technical skills
 - Establish a diagnostic and assessment plan for patients with great vessel disease
 - Select ideal treatment option for patient with great vessel disease, including perioperative monitoring, perfusion, and neuroprotective strategies
 - Manage routine postoperative complications
 - Institute and wean patient from cardiopulmonary bypass
 - Provide optimal perfusion and myocardial/neuro-protection
 - Perform routine aortic valvular replacement
 - Perform vascular anastomosis and complex great vessel replacement
 - Participate in aortic repair and endovascular aortic surgery
 - Participate in pulmonary thromboendarterectomy
 - Participate in hybrid approaches to complex aortic disease (e.g., debranching followed by endovascular procedure)

- End-stage cardiopulmonary disease
 - Medical knowledge
 - Identify pathology and understand the role of treatment on physiology of cardiac and pulmonary failure
 - Identify clinical manifestations of cardiac and pulmonary failure
 - List advantages and disadvantages of various treatment options for cardiac and pulmonary failure
 - Describe risks, benefits, and complications of treatment modalities (e.g., risk-benefit ratio)
 - Describe physiology of cardiac and pulmonary failure (cardiac—need for mechanical support such as VAD; pulmonary—need for advanced mechanical ventilation)
 - Discriminate between indications for transplantation or mechanical cardiopulmonary support (e.g., selection criteria for transplantation)
 - Identifies outcome literature for cardiac and pulmonary failure
 - Explain limitations of mechanical support, recognizes risks and benefits
 - Describe the immunologic mechanisms in cardiac and pulmonary transplantation
 - Explain non-pulsatile ventricular assist physiology
 - Describe clinical manifestations of allograft rejection (e.g., hyperacute, acute, and chronic rejection)
 - Describe clinical manifestations of complications of mechanical cardiopulmonary support (e.g., bleeding, line infection, sepsis, stroke, tamponade)
 - Differentiate between single vs. bi-VAD assist, cardiac vs. cardiopulmonary support, ECMO)
 - Recognizes outcomes for all treatment modalities and complications, including databases and clinical trials
 - Identifies and understands durable circulatory support devices: HeartMate II and III, left ventricular assist device, HeartWare, Syncardia Total Artificial Heart, Excor, pediatric ventricular assist device
 - Skills
 - Article I. Participate in care of patients with mechanical circulatory support
 - Article II. Participate in multidisciplinary team care of patients with end-stage cardiopulmonary meetings

Competency-based learning and teaching during pediatric cardiac surgery rotation

This rotation is one of the core rotations in cardiac surgery. This a six-month rotation in pediatric cardiac surgery. This rotation will be in the **Junior Residency in Specialty Cardiac Surgery** years (Year 5). All principles of CanMEDS and EPAs will be strictly applied, in addition to the following:

- I. Knowledge
 - Describe the basic anatomy and pathology of congenital heart disease
 - Describe the physiologic changes accompanying congenital heart disease (e.g., Eisenmenger syndrome)
 - Explain the advantages and disadvantages of diagnostic tools in evaluating congenital heart disease
 - Explain the advantages and disadvantages of various treatment options in congenital heart disease

- Identify knowledge of complications of congenital heart disease (e.g., residual VSD, heart block)
- Describe the basics of the single ventricle pathway (e.g., Truncus, Norwood, transposition of the great arteries [TGA])
- Interprets normal and common abnormalities associated with congenital heart disease, including echocardiography (e.g., identifies valve stenosis and regurgitation)
- Recognize the risks, benefits, and complications of various treatment modalities
- Describe complex integrations between anatomy and pathology (e.g., right ventricular [RV] dependent coronary sinusoids)

II. Skills

- Interpret the radiologic imaging of thoracic abnormalities, as chest x-ray, CMR, and cardiac CT
- Categorize the patients who undergo surgery based on their preoperative evaluation
- Operate the principle of myocardial protection, cardiopulmonary resuscitation, e-CPR
- Demonstrate a clear management plan to the common pediatric cardiac surgery conditions as coarctation of the aorta, the atrial septal defect, atrioventricular canal defects, cardiac arrhythmias, hypertrophic cardiomyopathy, tetralogy of Fallot with pulmonary stenosis, and congenital anomalies of the mitral valve
- Solve the postoperative possible surgical complications specific pediatric
- Apply the standard process for taking a patient's consent
- Practice risk assessment to identify patients at higher risk
 - Distinguish clinically between coma, delirium, seizures, and stroke
 - Apply appropriate monitoring and end points of resuscitation
 - Recognize the need for nutritional support for surgical patients in the perioperative phase
 - Distinguish between palliative care and end-of-life care
 - Describe the cardiopulmonary bypass: technique and pathophysiology
 - Interpret ABG results
 - Assist in all congenital heart procedures
 - Perform three closed congenital heart procedures
 - Perform eight open congenital heart procedures

Competency-based learning and teaching during subspecialty cardiac surgery rotation

This rotation is one of the core rotations in the program. It is a six-month rotation in one subspecialty of cardiac surgery. The candidate will have the freedom to select only one subspecialty during this rotation:

- Adult cardiac surgery
- Pediatric cardiac surgery

This will be the final rotation in R7 before graduation.

All principles of CanMEDS and EPAs will be strictly applied, in addition to the following:

a. **Knowledge**

- Acquire advanced level and state of the art of medical knowledge

b. Emergency and acute care management

- Demonstrate knowledge of essential medications used in acute care, including indications, contraindications, and adverse effects.
- Identify and respond appropriately to urgent and complex cases such as:

c. Procedural skills

- Participate in 100 cases with complete involvement in their perioperative care

d. Clinical skills

- Participate in 100 cases with complete involvement in their perioperative care

ACADEMIC ACTIVITIES

1.1 General principles

1. Teaching should contain both:
 - a) a structured-programmatic component, and
 - b) a practice-based component.
2. Efforts should be directed to move trainees toward greater responsibility for self-directed learning.
3. Every week, at least two to four hours of formal training time (commonly referred to as an academic half-day) should be reserved. A formal teaching time is an activity that is planned in advanced with an assigned tutor, time slot, and venue. Formal teaching time excludes bedside teaching, clinic postings etc. .An example for the half day is demonstrated in Appendix G.
4. Formal training time would include the following three formal teaching activities:
 - i. Universal topics: 20–30%
 - ii. Core specialty topics: 40–50% (examples are provided in Appendices D and E)
 - iii. Trainee selected topics: 20–30%. These are point of interest to some residents outside the scope of routine teaching, but it may offer significant public or institutional interest. These topics are changeable based on the residents' interests.
 - iv. 5C course
5. Formal training time should be supplemented by other practice-based learning (PBL), such as:
 - a) Morning report or case presentations
 - b) Morbidity and mortality reviews
 - c) Journal clubs
 - d) Grand rounds
 - e) Continuous professional activities (CPD) relevant to the specialty
6. Every two weeks, at least one hour should be assigned by trainees to meet with their mentors to review performance reports (e.g., ITER, e-portfolio, mini-CEX, etc.).
7. Through the residency training committee, program directors, and chief residents, in coordination with academic and training affairs and regional supervisory committees, should work together to ensure the planning and implementation of academic activities as indicated in the curriculum. This should aim for the efficient use of available resources and the optimal exchange of expertise.

1.2 Universal topics

1. Universal topics are educational activities that are developed and aimed for all specialties.
2. Priority will be given to topics that are of:
 - High value
 - Interdisciplinary and integrated
 - Require expertise that might be beyond the availability of the local clinical training sites
3. One aspect of universal topics will be mandatory, as it was developed centrally by SCFHS and will be available as e-learning; personalized access will be granted for each trainee to access the online modules, with 20 credit hours mandated, and all residents are encouraged to take those during the first year of residency, as it applies to the very basic care of the cardiac surgery patients.

- Each universal topic will have a self-assessment at the end of the module.
 - As indicated in the “executive policies of continuous assessment and annual promotion,” universal topics will be a mandatory component of the criteria for the annual promotion of trainees from their current level of training to the subsequent level.
 - Please refer to Appendix C for detailed universal topics modules assigned to cardiac surgery training program, of which the following are mandated by the scientific council as the required 20 credit hours by SCFHS:
 - Medical fundamentals
 - Medical and surgical emergencies
 - Acute care
 - Frail elderly
 - Ethics and healthcare
4. Another aspect of universal topics will be presented in the formal half day of academic enrichment activities, distributed over the whole period of training as mentioned above (more details in Appendix C)

5C Course

In light of the emergence of SARS-CoV2 in late 2019, the Saudi Commission for Health Specialties launched its COVID-19 Critical Care Crash Course (5C) for physicians, to ensure the ability of all medical practitioners to appropriately care for patients with COVID-19 and deal with similar emerging epidemics. This 5C is designed to provide basic knowledge and skills to successfully manage critically ill patients with suspected or confirmed COVID-19 infection in a critical care setting. It aims to upskill non-intensivists to be able to work in critical care settings in a safe and effective manner when the need arises. This course will help healthcare organizations in KSA to expand the capacity of their critical care departments and enhance their ability to provide care for critically ill COVID-19 patients.

The eLearning gate is accessible for physicians registered through the national volunteering platform or direct registration via this link:

<https://5c.scfhs.org.sa/en/home/tracks>

ASSESSMENT OF LEARNING IN CARDIAC SURGERY RESIDENCY PROGRAM

1. Purpose of Assessment

Assessment plays a vital role in the success of postgraduate training.

Assessment will guide trainees and trainers to achieve the targeted learning competencies and objectives. On the other hand, reliable and valid assessment will provide excellent means for training improvement, as it gives appropriate feedback on aspects of curriculum development, teaching methods, and quality of learning environment. Assessment will serve the following purposes:

- a. Assessment of learners: Trainers use information from trainees' performance to inform them of improvement potential, and assess their level of competency for progress in their learning path.
- b. Center and faculty evaluation: Assessment criteria will drive trainers' development and perfection including reflections on the training centers' support and infrastructure.
- c. Program evaluation: Assessment outcomes will represent a quality metric that can improve learning tools, experience, and process.

For the sake of organization, assessment will be further classified into two main categories: formative and summative.

2. Formative Assessment

2.1. General principles

Trainees, as adult learners, should strive for feedback throughout their journey of competency from novice to mastery levels. Formative assessment (also referred to as continuous assessment) is the component of assessment that is distributed throughout the academic year, aiming primarily to provide trainees with effective feedback. Input from the overall formative assessment tools will be utilized at the end of the year to make the decision of promoting each individual trainee from current-to-subsequent training level. Formative assessment will be defined based on the scientific council recommendations (usually updated and announced for each individual program at the start of the academic year). According to the executive policy on continuous assessment (available online at www.scfhs.org), formative assessment will have the following features (with exceptions in extraneous situations such as COVID-19 pandemic):

- a. Multisource: a minimum of four tools
- b. Comprehensive: covering all learning domains (knowledge, skills, and attitude)
- c. Relevant: focusing on workplace-based observations, and recommendations of the trainers and the program directors
- d. Competency-milestone oriented: reflecting a trainee's expected competencies that matches the trainee's developmental level

Trainees should play an active role seeking feedback during their training.

On the other hand, trainers are expected to provide timely and formative assessment. SCFHS will provide an e-portfolio system (such as One45) to enhance communication and analysis of data arising from formative assessment.

2.2. Formative assessment tools

This section:

- Complies with SCFHS executive policy on continuous assessment (available online at www.scfhs.org)
- Lists the formative assessment tools that are approved by the scientific council/committee of the program
- Are outlined based on the learning domain (knowledge, skills, and attitude)
- Describes relevant information: aim, expectation, and frequency
- Provides a comprehensive assessment that can be applied for borderline failure
- Includes forms to be applied for each tool (listed in Appendix A)

المعيار	mini mum for prom otion	domai n	domain	R 1	R 2	R 3	R 4	R 5	R 6	R 7
Attendance (academic activity)	>50%	المعرفة	مهام اكاامية محددة	x	x	x	x	x	x	x
Weekly Quizes Participation (academic activity)	>50%	المعرفة	المشاركة في امتحانات المراجعة الاسبوعية واختباري التقويم المستمرالنصف سنوي	x	x	x	x	x	x	x
ACLS active certification	yes	المعرفة	مهام اكاامية محددة		x	x	x	x	x	x
BLS active certification	yes	المعرفة	مهام اكاامية محددة		x	x	x	x	x	x
5C active certification	yes	المعرفة	مهام اكاامية محددة	x	x	x	x	x	x	x
2 RESEARCH COURSES	yes for R3 to R4	المعرفة	مهام اكاامية محددة			x				
2 Topic presentation/dis cussion (academic activity)	yes	المعرفة	مهام اكاامية محددة	x	x	x	x	x	x	x
Passing Part 1 EXAM	>70%	المعرفة	إختبار					x		
Logbook score	>50%	المهارات	المهارات	x	x	x	x	x	x	x
at least 2 DOPS average score	>50%	المهارات	المهارات	x	x	x	x	x	x	x

ITER / FITER Evaluation average score	>50%	السلوك	السلوك	x	x	x	x	x	x	x
---	------	--------	--------	---	---	---	---	---	---	---

2.3. Tools description

المعيار	التفصيل	تقييم أداء المتدرب
Attendance (academic activity)	There is 42 sessions of academic activities throughout the year conducted virtually over ZOOM and all the residents have a mandate to attend with specific instructions to Cardiac Surgery Program Directors to assure that the residents and freed from all clinical duties and responsibilities to be able to attend from all around the kingdom and from anywhere on earth.	وفق نظام المعاييرة المرفق
Weekly Quizes Participation and 2 formative exams planned for late December, 2021 and July, 2022 (academic activity)	There is 30 planned weekly quizzes and 2 formative exams and all the residents have a mandate to participate with specific feedback to all residents and Cardiac Surgery Program Directors to highlight topics and subjects for improvements in knowledge gaps that the residents need to know about.	وفق نظام المعاييرة المرفق. ويتم حساب المشاركة لكل امتحان اسبوعي بدرجتين (2) والمشاركة في كل من اختباري التقويم المستمر النصف سنوي بعشرين (20) درجة فتكون مجموع درجات المشاركة مئة من مئة (100/100)
ACLS active certification	yes	شهادة سارية المفعول ويتم حسابها بمئة من مئة (100/100)
BLS active certification	yes	شهادة سارية المفعول ويتم حسابها بمئة من مئة (100/100)
5C active certification	yes	شهادة إتمام عشرين (20) ساعة ويتم حسابها بمئة من مئة (100/100)
2 RESEARCH COURSES	yes for R3 to R4	شهادة إتمام بنجاح ويتم حسابها بمئة من مئة (100/100)
2 Topic presentation/discussion (academic activity)	yes	تقرير بالاداء من رئيس المتدربين
Passing Part 1 EXAM	>70%	وفق نظام المعاييرة المرفق

Logbook score	>50%	وفق نظام المعايرة المرفق
at least 2 DOPS average score	>50%	وفق نظام المعايرة المرفق
ITER / FITER Evaluation average score	>50%	وفق نظام المعايير المرفق

2.3.1. Logbook

This is based on the skills learning domain. The required numbers should be reviewed and revised during each cycle of the Scientific Council terms.

Each resident should maintain a complete, accurate, and timely procedure logbook throughout the program. Any format will be acceptable until the One45 online logbook is endorsed by the scientific council, when it will become the only acceptable format. The number of required cases as well as the index cases are listed in the table below with complete stratification by the residents' level. R8 denotes any extra time needed to compensate or repeat any part to fulfill the curriculum requirements. Index cases are CABG, AVR, MVR, TVR, closed and open congenital cases.

	R1	R2	R3	R4	R5	R6	R7	R8	Totals
Assisted	20	20	30	70	150	150	150		590
Performed	10	10	15	20	30	30	30		145
Totals	30	30	45	90	180	180	180		735
Index cases									
CABG	0	0	0		26				26
AVR	0	0	0		7				7
MVR	0	0	0		5				5
TVR	0	0	0		3				3
Closed congenital cases	0	0	0		3				3
Open congenital cases	0	0	0		8				8

Aim: to capture the surgical experience of the resident throughout the program with particular emphasis on the index case delineated above.

Expectation: the resident should strive to attain more than what is listed, and he/she can be given supportive consideration down to 95% of these numbers with a strong recommendation of the program director and support of at least two other senior cardiac surgery consultants. Anything below that will need support from the majority of the scientific council with specific recommendation to attain lacking skills (such in the case of COVID-19 pandemic).

Frequency: it is recommended that the resident fills his/her report on a daily basis, and it be released by the program director not more than one week later on the One45 web page.

Future: innovative tools to improve beyond the logbook should be developed and verified by the scientific council such as “modified remote DOPS” to be installed in all accredited training centers.

2.3.2. ITER and FITER: In-training evaluation and final report

The supervisor should draft the ITER at the end of the middle of the clinical rotations by correlating the resident’s clinical excellence with good professional behavior and using it for giving meaningful feedback to the trainee, which is then finalized by the end of the rotation.

ITERS should be conducted with each clinical rotation.

ITERS are submitted to the local supervisory or academic affairs committee for each trainee based on the expected accomplishments during the clinical rotation; at least three ITERS should be used for the promotion purposes. Similarly, the FITER will be used for the purpose of testifying for the qualification of the trainee to set for the final exams.

It will utilize the forms in One45 (see Appendix).

Aim: This is based on the attitude domain.

These are assessment forms based on the direct interaction of the trainees with the faculty and the program director. These well-designed forms cover all aspects of a qualifying competency evaluation. Therefore, great attention and emphasis on the program director is needed to fulfill this very important responsibility.

Expectation: Each trainee is expected to score very high in this tool, as a general rule. The SCFHS grading will apply when considering promotion or obtaining a certificate of completion of the training requirements.

Frequency: This will depend of the number of rotations performed each year, but a minimum of three ITER evaluations will needed to be considered in the scientific council.

2.3.3. Structured academic activities; weekly academic day activities

This is based on the knowledge learning domain.

This component of formative assessment aims to evaluate the resident’s capacity to actively participate, to demonstrate understanding, and to deliver the learning contents of the weekly academic day activities.

Aim: To acquire and demonstrate basic science and clinical knowledge appropriately related to the practice of cardiac surgery, including:

- Applied anatomy
- Physiology and pathophysiology
- Pharmacology of common and pertinent drugs
- Pathology and sequelae
- Microbiology
- Various diagnostic and interventional imaging methods
- Technical knowledge for surgical procedures (preparations, incisions, materials, and instruments)
- Postoperative course and potential complications

Then apply that to the myriad of different aspects of the cardiac surgery field, such as:

- Critical care and postoperative management
- Cardiopulmonary bypass, myocardial protection and circulatory support
- Ischemic heart disease
- Heart valve disease
- Aortic vascular disease
- Cardiothoracic trauma
- Related disorders of the pleura (pneumothorax, hemothorax, chylothorax)
- Related disorders of the chest wall (pectus, sternum resection)
- Related disorders of the diaphragm (hernia, diaphragmatic paralysis)
- Disorders of the pericardium
- Disorders of the mediastinum
- Congenital heart disease
- Intrathoracic transplantation and surgery for heart failure

Expectation: Each resident should attend at least 75% of these activities and will be assessed through immediate feedback in the same sessions.

Frequency: This activity take place throughout the year as a resident-based activity during the half day of academic enrichment as dictated by the SCFHS.

2.3.4. Case-based discussion (CBD) (case presentation and discussion)

This is based on the knowledge learning domain.

Details related to timing and venue or telecommunication tools that will be implemented will be announced early in each training year by the scientific council.

The standard presentation structure has four parts:

1. Clinical case scenario, with one major complication
2. Topic review
3. Demonstration of a depth of knowledge and its contribution (for example, stating any controversy about the topic, together with the evidence from current literature). Aims include teaching the residents how to present their point of view and accept conflicting points of view in a respectful manner.
4. Jury discussions: evaluation and feedback per SCFHS policy. For each resident it will happen at least once per year.

Assessment form to be used by each committee member for each candidate is attached in the appendix.

2.3.5. DOPS: Direct observation for procedural skills

Definition

Direct observation in cardiac surgery residents' formative assessment refers to observation, assessment, immediate feedback, early debriefing, and documentation of actions taken by both teachers and learners during cardiac operations in real time. The critical factor that distinguishes direct observation from other forms of assessment is that the learner is observed performing authentic actions that occur naturally as part of routine operative experience.

Description

Assessed actions are focused mainly on the technical skills, but can be expanded to any of the CanMEDS roles and can involve interactions with patients, their relatives, hospital staff, colleagues, students, or supervisors. Although any of these individuals could contribute to a

learner's assessment (multisource feedback), direct observation generally implies the observations of an expert (usually the program director) in a strictly authentic formal arrangement as the learner is asked to perform a specific part of the surgical procedure and would be assessed both instantaneously and later by means of a standardized rating form. Ideally, learners would be provided with an early debriefing session to shape their learning.

Advantages

- Enables assessment of real-time performance of some aspects of CanMEDS roles
- Provides opportunities to assess important but infrequent actions
- Enables assessment of technical skills that cannot be measured in examinations or logbook tracking
- Highly useful as formative (learning) assessment, as immediate feedback is usually possible
- Assessments by experts in the field with a variety of perspectives
- Extreme (good or bad) behaviors in any of the CanMEDS roles are easily be identified, with important educational consequences
- Proven high value and validity

Success requisites:

- Need time to train observers to maturity to perfect a standardized structured assessment to maintain validity and reliability
- The situations observed may be extremely variable, so the resulting behaviors are highly varied
- Need timely, labor-intensive, deliberate feedback, documentation, and debriefings
- May have limited ability to assess other non-technical skills

Key points:

- Direct observation is one of many methods that assess actual behavior in the reality of clinical practice.
- Direct observation provides good conditions for formative evaluation (immediate feedback).
- Training raters are crucial to the proper use of most assessment tools that use direct observation.
- Although most input is based on unstandardized assessment, the many occasions for observation can cumulatively achieve reasonable validity and reliability.

Aim:

Direct observation of procedural skills (DOPS): a universal tool used to assess the resident's performance in the required essential and advanced clinical skills, the tool can be applied to assessing resident skills in real or simulated situations.

To ensure successful application of the tool, the following rules must be implemented in the program:

- The scientific council must encourage the use of the standardized form to map the required skills and generate opportunities for residents to be trained and evaluated for the required skills.
- Use of simulation is encouraged to limit the patients' inconvenience and potential harm, as long as the simulation techniques are acceptable.
- To complete the process, the resident should evaluate the assessment session and reflect on its findings.

Expectation:

Each resident subjected to DOPS should expect immediate feedback and appropriate debriefing.

Frequency:

This activity takes place throughout the year. Each resident should subject to DOPS at least once per academic year.

Examples of formative assessment tools are found in Appendix F.

3. Summative Assessment

3.1. General principles

Summative assessment is the component of assessment that primarily aims to make informed decisions on trainees' competency. In comparison to the formative assessment, a summative assessment does not aim to provide constructive feedback. For further details on this section,

please refer to the general bylaws and executive policy of assessments (available online at www.scfhs.org). To be eligible to sit for the final exams, a trainee should be granted a certification of training completion.

3.2. The assessment method uses a series of competences within four domains:

- Knowledge
- Skills
- Attitude
- Performance

3.3. The assessment method uses the following principal components.

3.3.1. Principles of cardiac surgery examination (Saudi board examination: Part I)

This written examination, which is conducted in a multiple-choice question format, is held at least once a year. The number of exam items, eligibility, and passing score will be in accordance with the SCFHS training and examination rules and regulations. Examination details and blueprints are published on the commission website: www.scfhs.org.

3.3.1.1. Therefore, Junior Residents' levels are from R1-R5 accordingly:

3.3.1.1.1. Junior Residency in General Cardiac surgery Year 1, Year 2 and Year 3

3.3.1.1.2. Junior Residency in Specialty Cardiac Surgery: Year 4 and Year 5

Junior residents who are allowed to enter Saudi Board P1 are R2,3,4,5

3.3.1.2. Failing Part 1 Exam will not prevent promotion from **R2, R3, and R4** to the next level. Promotion from R5 to R6 is only permitted by passing Part 1 Exam in addition to fulfilling the Formative Assessments

3.3.2. Final in-training evaluation report (FITER)

In addition to approval of the completion of clinical requirements (resident's logbook) by the supervising committee, FITER is also prepared by program directors for each resident at the

end of his or her final year in residency (R7). This report shall be the basis for obtaining the certificate of training program completion, and well as the qualification to set for the final cardiac surgery board exam.

3.3.3. Final cardiac surgery board examination (Saudi board examination: Part II)

The final Saudi board examination comprises of two parts, a written examination, and a clinical examination.

3.3.3.1. Written examination

This examination assesses the trainee's theoretical knowledge base (including recent advances) and problem-solving capabilities regarding the specialty of cardiac surgery. It is delivered in a multiple-choice question format and is held at least once a year. The number of exam items, exam format, eligibility, and passing score will be in accordance with the SCFHS training and examination rules and regulations. Examination details and blueprints are published on the commission website: www.scfhs.org.

3.3.3.2. Clinical examination

This examination assesses a broad range of high-level clinical skills, including data collection, patient management, communication, and counseling skills. The examination is held at least once a year, in the form of patient management problems (PMPs). The exam eligibility, format, and passing score will be in accordance with the SCFHS training and examination rules and regulations. Examination details and blueprints are published on the commission website:

<https://www.scfhs.org.sa/MESPS/TrainingProgs/TrainingProgsStatement/Documents/Blueprint%20CARDIAC%20SURGERY%202019.pdf>

3.4. Certification

Certificates of training completion will only be issued upon the resident's successful completion of all program requirements and recommendation in the FITER by the program director.

Candidates passing all components of the final specialty examination are awarded the Saudi board in cardiac surgery certificate, and are entitled to use the term "board-certified" in their official communications.

POLICIES AND PROCEDURES

This curriculum represents the means and materials outlining learning objectives with which trainees and trainers will interact for the purpose of achieving the identified educational outcomes.

The Saudi Commission for Health Specialties (SCFHS) has a full set of bylaws and executive policies (published on the official SCFHS website) that regulate all processes related to training.

General bylaws of training, assessment, and accreditation as well as executive policies on admission, registration, continuous assessment and promotion, examination, trainees' representation and support, duty hours, and leaves are examples of regulations that need to be applied. The most updated bylaws and policies can be accessed online (via the official SCFHS website) and will be the reference for all legal disputes.

Vacations and holidays:

During any academic year, each resident is allowed four weeks of vacation time in addition to any official holidays, and the final ruling on that is per the SCFHS policy (<https://www.scfhs.org.sa/en/MESPS/Policies/Pages/default.aspx>). The exact timing and rotations involved will be coordinated between the resident, the chief resident, and the program director, to be fitted within the following tables about rotations accordingly. This should take into consideration the specific needs of each resident as well as any external imposing circumstances (such as the COVID-19 pandemic).

APPENDICES

- A. Junior-level competency matrix
- B. Senior-level competency matrix
- C. Universal topic modules
- D. Top conditions and procedures in the specialty
- E. Scope of procedures in the cardiac surgery training program
- F. Examples of formative assessment tools
- G. Example table for half-day activities
- H. Glossary

APPENDIX A

Mapping of Milestones

Trainees are expected to progress from novice to mastery level in a certain set of professional competencies. SCFHS has endorsed CanMEDS to articulate professional competencies. The following is a general outline of each competency (adopted from Frank JR, Snell L, Sherbino J (eds.). CanMEDS 2015 Physician Competency Framework. Ottawa: Royal College of Physicians and Surgeons of Canada. 2015):

Junior-level (R1–5) competency matrix: to map competency, learning domain, and milestones

Competency matrix related to cardiac surgery							
Training year level	Competency roles (with annotation of learning domains involved: K: knowledge, S: Skills, A: Attitude)	Elicit a history pertinent to the clinical presentation.	Perform and interpret findings of a physical exam relevant to the cardiovascular system	Optimize the physical environment for patient comfort, privacy, engagement, and safety	Conduct a focused and efficient patient interview, managing the flow of the encounter while being attentive to the patient's cues and responses	Apply knowledge of the principles of diagnosis, natural history, and medical management of common cardiac presentations	Select and interpret appropriate investigations and imaging techniques
	Professional Expert	Develop a differential diagnosis relevant to the patient's presentation	Select and interpret appropriate investigations and imaging techniques <ul style="list-style-type: none"> • ECG • Coronary angiography/CAT angiogram • Non-invasive testing • Viability—nuclear, PET, MRI • Echo/stress echo 	Develop a plan for cardiac surgery, including, as appropriate, strategies for myocardial protection, coronary revascularization and conduit selection	Develop and implement initial management plans	Apply clinical and biomedical sciences to manage core patient presentations in cardiac surgery, anatomy and physiology of the cardiovascular system, pathology and pathophysiology as relevant to cardiovascular diseases and conditions	Develop and implement management plans for complications in cardiac surgery patients
R 1,2,3,4,5							

Communicator	Communicate with the receiving physicians or healthcare professionals during transitions in care, clarifying issues after transfer as needed	Document clinical encounters to adequately convey clinical reasoning and the rationale for decisions	Consider urgency and potential for deterioration, in advocating for the timely execution of a procedure or therapy	Use strategies to verify and validate the understanding of the patient and family regarding the diagnosis, prognosis, and management plan	Understand steps of procedure, potential risks, and means to avoid/overcome them	Integrate the biopsychosocial information obtained from a patient-centered interview. Document the consent discussion in an accurate and complete manner. Use effective communication skills and strategies, such as body posture, language at the appropriate level, and periodic checks for understanding
Collaborator	Integrate the patient's perspective and context into the collaborative care plan	Consult other health professionals appropriately with regard to patients' social, rehabilitative, and nutritional concerns	Apply appropriate secondary prevention strategies for cardiac vascular diseases, according to current guidelines			

APPENDIX B

Mapping of Milestones

Trainees are expected to progress from novice to mastery level in a certain set of professional competencies. SCFHS has endorsed CanMEDS to articulate professional competencies. The following is a general outline of each competency (adopted from adopted from Frank JR, Snell L, Sherbino J (eds.). CanMEDS 2015 Physician Competency Framework. Ottawa: Royal College of Physicians and Surgeons of Canada. 2015):

Senior-level (R6–7) competency matrix: to map competency, learning domain, and milestones

Training Year level	Competency roles	Competencies Matrix Related to Cardiac surgery					
	(with annotation of learning domains involved: K: knowledge, S: Skills, A: Attitude)	Gather/assess required information to reach diagnosis and determine correct procedure required	Establish and implement a plan for post-procedure care	Respond punctually to requests from patients or other healthcare providers	Make effective use of the scope and expertise of other healthcare professionals	Seek and interpret multiple sources of performance data to continuously improve performance	Access and apply relevant information to clinical practice. Demonstrate effective consultation services with respect to patient care, education, and legal opinions.
R6,7	Professional Expert	Apply a broad base and depth of knowledge in clinical and biomedical sciences to manage the breadth of patient presentations in cardiac surgery <ul style="list-style-type: none"> immunology of rejection pharmacology of immunosuppression 	Apply knowledge of the indications, techniques, and complications for core surgical procedures <ul style="list-style-type: none"> Mechanical circulatory support, including IABP, ECMO, VAD Surgical therapy for heart failure including valve surgery, ventricular reconstruction, VAD insertion and transplantation 	Maintain capacity for professional clinical performance in stressful situations	Obvious planned course of procedure with economy of movement and flow	Carry out professional duties in the face of multiple, competing demands. Perform common procedures in a skillful, fluid, and safe manner with minimal assistance	Demonstrate effective procedure preparation, including the use of a pre-procedure time-out or safety checklist as appropriate

Communicator	Communicate the reasons for unanticipated clinical outcomes to patients and disclose patient safety incidents	Adapt record keeping to the specific guidelines of their discipline and the clinical context	Achieve consensus when there are differences in recommendations provided by other healthcare professionals	Discuss appropriate information with patients and families, and the healthcare team	Listen effectively	Obtain and synthesize relevant history from patients and families, and their communities.
Collaborator	Consult as needed with other healthcare professionals, including other physicians	Professional and effective communication/ utilization of staff	Determine if/when care should be transferred back to the referring/primary care physician	Delegate responsibilities to members of the healthcare team appropriate to their scope of practice and level of expertise	Convey plan for surgical approach to the operating team	Summarize the patient's issues in the transfer summary, including plans to deal with ongoing issues

APPENDIX C

Universal Topic Modules

Intent:

These are high-value, interdisciplinary topics of the utmost importance to the trainee. The reason for delivering the topics centrally is to ensure that every trainee receives high-quality teaching and develops essential core knowledge. These topics are common to all specialties.

Topics included here meet one or more of the following criteria:

- Impactful: topics that are common or life-threatening
- Interdisciplinary: topics that are difficult to teach within a single discipline
- Orphan: topics that are poorly represented in the undergraduate curriculum
- Practical: topics that trainees will encounter in hospital practice

Requirement in training:

All residents must complete 20 hours' study.

All residents are encouraged to do this ONCE during the FIRST YEAR OF TRAINING as a mandate for promotion every year.

Any extra or refreshment training hours is encouraged during the remaining years of the program.

The list of mandated courses is:

1. Medical fundamentals
2. Medical and surgical emergencies
3. Acute care
4. The frail elderly
5. Ethics and healthcare

Development and delivery:

Core topics for PG curriculum will be developed and delivered centrally by the commission through e-learning platform. A set of preliminary learning outcomes for each topic will be developed. Content experts, in collaboration with the central team, may modify the learning outcomes.

These topics will be didactic in nature with a focus on the practical aspects of care. These topics will be more content-heavy compared to workshops and other face-to-face interactive session planned.

The suggested duration of each topic is 1.5 hours.

Assessment: The topics will be delivered in a modular fashion. At the end of each learning unit there will be an online formative assessment. After the completion of all topics, there will be a combined summative assessment in the form of context-rich multiple-choice questions (MCQs). All trainees must attain minimum competency in the summative assessment. Alternatively, these topics can be assessed in a summative manner along with the specialty examination.

Suggestions: May include case studies, high-quality images, successful examples of prescribing drugs in disease states, and Internet resources.

APPENDIX D

Top conditions and procedures in the specialty

Top Causes of Heart Disease Mortality in Saudi Arabia*			
	Disease; Conditions	Relative Frequency	Cumulative Frequency
1	Coronary artery Disease	40%	40%
2	Valvular Heart Disease	35%	75%
3	Congenital Heart Disease	15%	90%

Top Cardiac Tumors			
	Disease; Conditions	Relative Frequency	Cumulative Frequency
1	Metastatic	95%	95%
2	Primary, Myxoma	4%	99%
3	Primary, others	1%	100%

Top Causes of Out-Patient Consultations Related to Specialties in Saudi Arabia			
	Disease; Conditions	Relative Frequency	Cumulative Frequency
1	Angina	30%	30%
2	Palpitations	30%	60%
3	Shortness of Breath	25%	85%

Top Causes of In-patient Admissions Related to Specialties in Saudi Arabia			
	Disease; Conditions	Relative Frequency	Cumulative Frequency
1	Ischemic Heart Disease	50%	50%
2	Heart Failure	30%	80%
3	Arrhythmia	10%	90%

Examples of Core Specialty Topics: Case Discussions, Interactive Lectures

	Section	<i>Date</i>	1st sessions	Presenter	2nd sessions	Presenter	3rd session	Presenter
1	Fundamentals in cardiac surgery	10/17/19	Welcome session		Cardiac physiology (action potential cardiac cycle, circulation, regulation of blood pressure)		Hemodynamic physiology (volume pressure loop, assessment of cardiac output and perfusion)	
2		10/24/19	Anatomy of cardiac chambers and valve and conduction system		Anatomy of great vessels and coronary arteries and venous and arterial conduits			
3		10/17/19	Preoperative evaluation of cardiac surgery and risk stratification		Postoperative care of cardiac surgery patients		Perioperative care in cardiac surgery guidelines 2019	
4		10/24/19	Basics of Basics of ECG		Blood products and transfusion in cardiac surgery			
5		10/31/19	Basics of coronary angiogram		Echo (TTE and TEE)			
6		11/7/2019	CT, MRI, stress echo; principles and indication		Cardiac surgical pharmacology			
7		11/14/19	Cardiac Anesthesia		Late complications of cardiac surgery			
8		11/21/19	Cardiac Arrhythmias and blocks post cardiac surgery		Pacemaker and defibrillator therapy in cardiac surgery			
9		11/28/19	Cardiopulmonary Bypass 1		Cardiopulmonary bypass 2 / pitfalls in CPB case scenarios		Aortic atherosclerosis and stroke with CPB—review presentation	
10		12/5/2019	Deep hypothermic circulatory arrest and selective cerebral perfusion		Myocardial protection		Myocardial protection pitfalls case scenarios / MOCK EXAM	

11	Coronary Artery Disease	12/12/2019	Pathophysiology of CAD	Myocardial infarction and indication for revascularization: ACS (latest American and European guidelines)	Review of MOCK EXAM + EXCEL and NOBEL trial
12		12/19/19	Myocardial revascularization with CBP	Myocardial revascularization without CBP	STITCH trial and 10 years follow up

Top Procedures/Surgeries Performed by Specialty

Name of Procedures/ Surgeries	Approximate Frequency
Coronary Artery Bypass	55%
Heart Valve repair/replacement	25%
Atrial/Ventricular Septal Defect Repair	10%
ECMO	5%

Examples of Core Specialty Topics: Workshops/Simulation

Topics	Comments
Sutures in Dry-lab setting	once or more per year
Aortic Valve Surgery Simulations	once or more per year
mitral Valve Surgery Simulations	once or more per year
Coronary Artery Bypass Surgery Simulations	once or more per year

APPENDIX E

Scope of procedures in the cardiac surgery training program

The cardiac procedures performed throughout the kingdom include but are not limited to:

Aortic arch surgery
Aortic dissection
Aortic valve repair / replacement
Arterial vascular cut-down
Ascending aortic aneurysm
ASD
ASO
Axillary cannulation (for bypass)
Bental/Cabrol/valve-sparing root*
Bronchoscopy
Cardiac transplantation
Cardiac tumors/masses
Coronary artery bypass grafting
CPR
Cricothyroidotomy
Coarctation repair
Diaphragmatic plication
ECMO insertion
ER thoracotomy
Femoral arterial line insertion
Femoral cannulation (for bypass)
Femoral venous line insertion
Femoral/femoral bypass
Fontan
Glenn shunt
Harvest of heart, heart/lung
IAA interrupted aortic arch
IABP insertion
Infarct VSD/rupture
Internal mammary artery harvest
MBTS modified Blalock Taussig shunt
Median sternotomy
Mediastinal tumor
Mediastinoscopy
Myxoma
Norwood
Mitral valve repair/replacement
Pacemaker and defibrillator insertions
PAPVD partial anomalous pulmonary venous connection
Pleurodesis, pleurectomy

Pneumonectomy
Pulmonary embolectomy
Radial arterial line insertion
Radial artery harvest
Re-do sternotomy
PDA ligation
RV to PA conduit
Saphenous vein harvest
Surgery for atrial fibrillation
Swan Ganz catheter insertion
TAPVD total anomalous pulmonary venous connection
TAVI
Tenckhoff catheter insertion
TEVAR
Thoraco-abdominal aortic aneurysm repair
Thoracostomy (chest) tube insertion
Thrombectomy
TOF—tetralogy of Fallot
Tracheotomy
Transplantation—lung, combined heart/lung, Heart
Tricuspid Valve Procedure
TRUNCUS
VAD insertion
VATS diagnostic, pleurodesis, wedge resection
Venous vascular cut down
VSD
Wound closure and wound care
Harvest of heart, heart/lung

APPENDIX F

Examples of Assessments Forms.

CBD

Case based Discussion (CbD)

***Brief description of case including curricula areas covered:**

	n/a	Below expectations 1	Borderline 2	Meets expectations 3	Above expectation 4
*Domain & Comments Clinical Assessment :	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Investigations and referrals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Management plan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Follow-up and future planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Overall clinical judgement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***comments:**

***Which aspects of the encounter were done well?**

***Suggested areas for improvement / development?**

***Agreed Actions / learning plan:**

***Assessor's position:**

- Consultant
- Associate Consultant
- Senior Registrar
- Registrar
- Fellow
- other

Others (specify):

***Complexity of Case:**

- Low
- Average
- High

***Time taken for Observation & Feedback (in minutes)**

***Basis for discussion:**

- Outpatient case/record/letter
- Discharge Summary
- Inpatient case/consult/record

The following will be displayed on forms where feedback is enabled...

(for the evaluator to answer...)

***Did you have an opportunity to meet with this resident to discuss their performance?**

- Yes
- No

(for the evaluatee to answer...)

***Are you in agreement with this assessment?**

- Yes
- No

Please enter any comments you have (if any) on this evaluation.

Assessments Forms ITER

*Indicates a mandatory response

ITER - IN-TRAINING EVALUATION REPORT (M.R.CardSx)

	N/A (0)	Clear Fail (1)	Borderline (2)	Clear Pass (3)	Exceed Expectations (4)
*A. MEDICAL EXPERT:					
History & Physical Examination:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1. Comprehensive, accurate & concise with all relevant details					
*Diagnostic Tests:					
2. Used in a cost-effective manner & understands limitations & predictive value.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Clinical Decision:					
3. Able to formulate appropriate differential diagnosis.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*4. Able to analyze, integrate, and formulate effective management strategies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Medical Knowledge:					
5. Broad Clinical & Basic knowledge of a wide variety of medical problems and develops a plan of secondary prevention.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Emergency Management:					
6. Able to identify and respond appropriately to urgent cases	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	N/A (0)	Clear Fail (1)	Borderline (2)	Clear Pass (3)	Exceed Expectations (4)
*Evidence-based Practice/Critical Appraisal Skills:					
7. Aware of the role of evidence in clinical decision-making.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*8. Able to apply relevant information in problem-solving.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*9. Demonstrates knowledge of medications used, mechanisms of action, clinically relevant pharmacokinetics, indications, contraindications, and adverse effects.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Procedural Skills:					
10.. Perform diagnostic & therapeutic procedures, understands indications, limitations & complications.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*B. COMMUNICATOR					
11. Communicates effectively with patients, their families, and HCPs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*12. Able to maintain clear, accurate & appropriate records.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*13. Written orders and progress notes are well organized & legible.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*14. Discharge summaries are concise & completed promptly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*C. COLLABORATOR:					
15. Works effectively in a team environment with attending, juniors & nursing staff.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*D. MANAGER :					
16. Serves in administration and leadership roles as appropriate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	N/A (0)	Clear Fail (1)	Borderline (2)	Clear Pass (3)	Exceed Expectations (4)
*17. Appropriate & efficient use of health care resources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*E. SCHOLAR :					
18. Attends and contributes to rounds, seminars, and other learning events.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*19. Accepts and acts on constructive feedback.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*20. Contributes to the education of patients, junior residents, house staff, and students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*21. Contributes in scientific research.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*F. HEALTH ADVOCATE :					
22. Able to identify the psychosocial, economic, environmental & biological factors which influence the health of patients and society.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*23. Offers advocacy on behalf of patients at practice and general population levels.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*G. PROFESSIONAL :					
24. Delivers the highest quality of care with integrity & compassion. Recognizes limitations and seeks advice and consultations when necessary.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*25. Reflects the highest standards of excellence in clinical care and ethical conduct.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*Comments (areas of strengths/areas for improvement)

The following will be displayed on forms where feedback is enabled...
(for the evaluator to answer...)

*Did you have an opportunity to meet with this resident to discuss their performance?

- Yes
- No

(for the evaluatee to answer...)

*Are you in agreement with this assessment?

- Yes
- No

Please enter any comments you have (if any) on this evaluation.

Assessments Forms FITER

* indicates a mandatory response

Final in-Training Evaluation Report (FITER) Form

	Rarely meets(1)	Inconsistently meets(2)	Generally meets(3)	Exceeds(4)
*A. Medical Expert:				
1. Basic science pertinent to cardiac surgery.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*2. History and physical examination.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*3. Keeping medical records.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*4. Ordering appropriate laboratory and imaging investigations, with reasonable interpretation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*5. Providing effective planning, management and patient care.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*6. Understand implications of co-existing diseases with appropriate consultations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*7. Understand implications of surgical interventions and emergencies and call for help when appropriate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*8. Accomplish and maintain required certification of BLS and ACLS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*9. Demonstrate effective Postoperative pain management assessment and therapy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*10. Awareness of hospital policy and procedures pertinent to patients' safety and abuse issues.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*11. Awareness of law of the Kingdom of Saudi Arabia and pertinent patient care regulations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*12. Assessment and management of the normal and difficult airway with or without tracheal intubation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*13. Being able to lead or being a part of the team to handle code situation with basic and advanced life support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*14. Assessing, obtaining and management of all sorts of vascular access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*15. Performing E-CPR	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*16. Placement of IABP	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*17. Performing sternotomy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*18. Performing harvesting saphenous vies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*19. Performing harvesting internal thoracic artery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*20. Performing cannulation for cardiopulmonary bypass	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*21. Managing and weaning off cardiopulmonary bypass	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*22. Performing emergency chest opening in cardiac surgery ICU	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*23. Performing chest closure in cardiac surgery ICU	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*24. Placement of temporary and permeant pacer wires	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*25. Pacemaker insertion and management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*26. Chest tubes and drains placement and management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*27. Performing distal and proximal coronary anastomoses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*28. Performing aortic valve replacement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*29. Performing mitral valve repair or replacement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*30. Management of anticoagulation medication	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*31. Management of sternal wound infection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*32. Management of unstable sternum	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*33. Management of pulmonary hypertension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*34. Assessing and management of all sorts of intracardiac and pulmonary shunt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*35. Intravenous fluid management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*36. Assessing and management of hemotherapy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37. Assessing and management of cerebral circulation/protection and postop CVA risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*38. Assessing and management of myocardial circulation/protection and postop myocardial dysfunction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*B. Communicator:				
1. Communicate with patients of different age groups in caring, compassionate and professional manner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*2. Establishes rapport with patients providing clear and appropriate explanations of surgical plans, risks and concerns.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*3. Establishes good relationships with peers and health professionals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*4. Meticulous written documentation and clear verbal communication skills.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*5. Effective presentation skills in teaching colleagues, residents, students, and health care professionals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*C. Collaborator :				
1. Collaborates effectively and constructively with other multidisciplinary teams in the Operating room/ER/ ICU and in situations of disaster/crisis and contributes effectively to team needs and activities, being a team player.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*2. Utilization of resources in Perioperative preparation of patients, such as preoperative consultation of other physicians and health professionals and patients education throughout all encounters.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*3. Research collaboration with co-investigators from different subspecialty areas, national and international collaborators.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*D. Manager:				
1. Awareness and implementation of cost effectiveness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*2. Adoption and maintenance of efficient time management.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*3. Demonstration of leadership skills in organization, conflict management, delegation, and coordinating the work between care team members and facilitation seamless coordinated care delivery to patients.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*4. Participation in performance improvement and quality management with timely feedback.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*5. Effective use of information technology in enhancing patient care.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*E. Health Advocate :				
1. Preparation for, and anticipation of potential complications of cardiac surgery patients in the perioperative period as well as in discharge and long term care planning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*2. Exploring pertinent new medical technologies to improve efficiency and effectiveness of healthcare resources utilization.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*3. Involvement in community, hospital or departmental activities aimed at improving patient safety.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*F. Scholar :				
1. Develops and implements an ongoing, effective lifelong learning strategy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*2. Applies the principles of evidence-based standards of care.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*3. Completes a research project to the satisfaction of the program director.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*4. Critically appraises and integrates medical information in published articles.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*5. Helps others learn by providing reference materials and constructive feedback.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*6. Attendance and participation in medical knowledge and academic enrichment program's activities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*7. Attendance and participation in national and international scientific meetings (case presentations, grand rounds, M&M meetings, Saudi Heart conferences, etc.).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*G. Professional :				
1. Demonstrating appropriate accountability and responsibility in regard to on-call duties, punctuality, reliability and preparedness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*2. Accomplishment of appropriate preoperative preparation and postoperative follow-up and management.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*3. Practices with integrity, honesty, compassion, and respect for all.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*4. Application of the principles of medical ethics and work within ethical and legal boundaries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*5. Getting informed consent as per hospital policy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*6. Awareness of personal limitations, seeking help and accepting advice whenever indicated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The following will be displayed on forms where feedback is enabled...

(for the evaluator to answer...)

*Did you have an opportunity to meet with this resident to discuss their performance?

Yes

No

(for the evaluatee to answer...)

*Are you in agreement with this assessment?

Yes

No

Please enter any comments you have (if any) on this evaluation.

Assessments Forms DOPS

Direct Observation Of Procedural Skills – DOPS Assessment

*Procedure:

	n/a	Below expectations 1	Borderline 2	Meets expectations 3	Above expectation 4
*Domain & Comments: Professional Approach (to include communication, consent and consideration of the patient.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Knowledge (indication, anatomy, technique)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Demonstrate appropriate pre-procedure preparation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Appropriate analgesia or/and sedation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Technical Ability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Aseptic Technique	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Post Procedure Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Needs more practice	May need supervision if complications arise	Competent to perform unsupervised
*Overall Ability to perform Procedure:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*Comments:

*Assessor's position:

- Consultant
- Associate Consultant
- Senior Registrar
- Registrar
- Fellow
- Senior Resident
- Nurse
- other

Others (specify):

*Complexity of procedure:

- Low
- Average
- High

*Time taken for Feedback & Observation (in minutes):

The following will be displayed on forms where feedback is enabled...

(for the evaluator to answer...)

*Did you have an opportunity to meet with this resident to discuss their performance?

- Yes
- No

(for the evaluatee to answer...)

*Are you in agreement with this assessment?

- Yes
- No

Please enter any comments you have (if any) on this evaluation.

Assessments Forms Research Milestones Progression



Resident's Name	<input type="text"/>	Date	/ /
Level of Training	<input type="text"/>	Location	<input type="text"/>
Assessor's Name	<input type="text"/>	Position	<input type="text"/>
Research Title	<input type="text"/>		

Progression Status:

Items	1st attempt	2nd attempt	3ed attempt	Completed	SV signature
1 Proposal Writing	/ /	/ /	/ /	<input type="radio"/> YES <input type="radio"/> NO	
2 Ethical and administrative Approval	/ /	/ /	/ /	<input type="radio"/> YES <input type="radio"/> NO	
3 Literature review	/ /	/ /	/ /	<input type="radio"/> YES <input type="radio"/> NO	
4 Research tools generation	/ /	/ /	/ /	<input type="radio"/> YES <input type="radio"/> NO	
5 Data collection	/ /	/ /	/ /	<input type="radio"/> YES <input type="radio"/> NO	
6 Data entry	/ /	/ /	/ /	<input type="radio"/> YES <input type="radio"/> NO	
7 Analysis	/ /	/ /	/ /	<input type="radio"/> YES <input type="radio"/> NO	
8 Discussion	/ /	/ /	/ /	<input type="radio"/> YES <input type="radio"/> NO	
9 Conclusion & Recommendation	/ /	/ /	/ /	<input type="radio"/> YES <input type="radio"/> NO	
10 Thesis writing	/ /	/ /	/ /	<input type="radio"/> YES <input type="radio"/> NO	

Supervisor's Comments:

.....

.....

.....

.....

Supervisor's Name and Signature	Resident's Name and Signature	PD (or equivalent) Name and Signature
<input type="text"/>	<input type="text"/>	<input type="text"/>

APPENDIX G

The following is an example illustrating the half-day activities for one year.

	Section	Date	1st sessions	Presenter	2nd sessions	Presenter	3rd session n	Presenter
1	Fundamentals in cardiac surgery	10/3/19	Welcome session		Cardiac physiology (action potential cardiac cycle, circulation, regulation of blood pressure)		Hemodynamic physiology (volume pressure loop, assessment of cardiac output and perfusion)	
2		10/10/19	Anatomy of cardiac chambers and valve and conduction system		Anatomy of great vessels and coronary arteries and venous and arterial conduits			
4		10/17/19	Preoperative evaluation of cardiac surgery and risk stratification		Postoperative care of cardiac surgery patients		Perioperative care in cardiac surgery guidelines 2019	
		10/24/19	Basics of ECG		Blood products and transfusion in cardiac surgery			
5		10/31/19	Basics of coronary angiogram		Echo (TTE and TEE)			
		11/7/19	CT, MRI, stress echo; principles and indication		Cardiac surgical pharmacology			
6		11/14/19	Cardiac anesthesia		Late complications of cardiac surgery			
8		11/21/19	Cardiac arrhythmias and blocks post cardiac surgery		Pacemaker and defibrillator therapy in cardiac surgery			
9		11/28/19	Cardiopulmonary bypass 1		Cardiopulmonary bypass 2; pitfalls in CPB case scenarios		Aortic atherosclerosis and stroke with CPB—review presentation	

10		12/5/2019	Deep hypothermic circulatory arrest and selective cerebral perfusion		Myocardial protection		Myocardial protection pitfalls case scenarios / mock exam	
11	Coronary artery disease	12/12/19	Pathophysiology of CAD		Myocardial infarction and indication for revascularization : ACS (latest American and European guidelines)		Review of mock exam + EXCEL and NOBEL trial	
12		12/19/19	Myocardial revascularization with CBP		Myocardial revascularization without CBP		STITCH trial and 10 years follow up	
13		12/26/19	CABG in acute myocardial infarction		Surgical management of mechanical complications post MI		SYNTAX 10 years and FREEDOM 10 years	
14		1/2/2020	Carotid disease and combined CAD and carotid disease		Total arterial revascularization		Ruby and coronary trials + mock exam	
16	Valvular heart disease	1/9/2020	Pathophysiology of aortic valve disease (including bicuspid AV)		Latest AHA aortic valve guidelines (AS, AR, bicuspid) 2014+ 2017 update		Review of mock exam	
17		1/16/2020	Aortic valve replacement with mechanical prosthesis		Stented bioprosthesis aortic valve replacement		Resuscitation after cardiac surgery guidelines	
18		1/23/2020	Stentless aortic valve replacement and root replacement		Repair of aortic valve and valve sparing operations		Partner trilogy	
19		1/30/2020	TAVI		Pathophysiology of mitral disease		TAVI for low risk patients with self-expanding valve	
20		2/6/2020	Mitral valve repair		Repair of rheumatic mitral disease			

APPENDICES

21		2/13/2020	Valvular and ischemic heart disease		Surgery for functional MR	STS net trial for severe and moderate ischemic MR	
22		2/20/2020	Mitral valve replacement		Tricuspid valve disease	Latest mitral guidelines (MS+MR) 2014+2017 update	
23		2/27/2020	Surgical treatment for aortic valve endocarditis		Surgical management of mitral and tricuspid endocarditis	Infective endocarditis guidelines (AATS 2016)	
24		3/5/2020	Multiple valve disease		Reoperative valve surgery	Restrictive vs liberal PRBCs transfusion in cardiac surgery trial (or 2019 meta-analysis)	
25						Mock exam	
26	Surgery of the great vessels	3/12/2020	Aortic dissection		Aortic aneurysm ascending	Review of mock exam Case scenario—AO dissection with stroke	
27		3/26/2020	Descending aorta and thoraco-abdominal aneurysms		Endovascular therapy for the treatment of thoracic aortic disease	Latest aortic pathology guidelines (STS 2010 / ECS 2014)	
28	Others	4/2/2020	Cardiac tumors		Surgery for adult congenital heart disease	AHA 2008—or recent—adult congenital heart disease guidelines	
29		4/9/2020	Surgery for cardiac arrhythmias		Pericardial diseases	Surgical treatment of A-fib guidelines 2017 STS	
30		4/16/2020	Trauma to the great vessels		Pulmonary embolism and thrombo-endarterectomy	Hypertrophic cardiomyopathy overview and surgical role	
31	Surgical management for heart failure	4/23/2020	Cardiac transplant, indications, and results		Complication of the transplantation and immunology and drugs		

32		6/4/2020	Short term mechanical support		Long term mechanical support		Momentum 3 trial (Heartmate 3)	
33	Congenital cardiac surgery	6/11/2020	Developmental anatomy		Anatomy of congenital cardiac malformation		Transplant and mechanical support guidelines (2013 or more recent ISHLT guidelines /2016 ECS heart failure guidelines)	
34		6/18/2020	CPB in pediatric patients		Anomalies of the coronary arteries		Mock exam	
35		6/25/2020	Palliative operation for CHD		ASD and PAPVD		Review of Mock exam	
36		7/2/2020	PDA and vascular rings		Single ventricle			
37		7/16/2020	Subvalvular, valvular and supra valvular aortic stenosis		Interrupted aortic arch and aortic coarctation			
38		7/23/2020	Tetralogy of Fallot (with pulmonary stenosis, with pulmonary atresia)		TGA, congenitally corrected TGA			
39		8/13/2020	Double outlet RV		AV canal defect and truncus arteriosus			
40		8/20/2020	VSD		Total anomalous pulmonary venous drainage			
41		8/27/2020	Ebstein's anomaly		Mock exam and review			

GLOSSARY

Glossary	
Blueprint	Description correlating educational objectives with assessment contents. For example, the test blueprint defines the proportion of test questions allocated to each learning domain and/or content.
Competency	Capability to function within a defined professional role that implies the entrustment of a trainee by graduation from the program with the required knowledge, skills, and attitude needed to practice unsupervised.
The CanMEDS 2015 Framework	CanMEDS is an educational framework that describes the abilities physicians require to effectively meet the health care needs of the people they serve. It is the basis for the educational and practice standards of the Royal College. CanMEDS 2015 is the third edition of the CanMEDS Physician Competency Framework and was officially released in October 2015. CanMEDS 2015 is endorsed by 12 Canadian medical organizations.
Specialty core content (skills, knowledge, and professional attitude)	A specific knowledge or skill or professional attitude that is specific and integral to the given specialty.
FINER	FINER stands for "feasible, interesting, novel, ethical, and relevant." The FINER framework* is used for formulating research questions. FINER allows researchers to ponder the philosophical, logical, and scientific implications of writing research questions.
Formative assessment	An assessment that is used to inform the trainer and learner of what has been taught and learned, respectively, for the purpose of improving learning. Typically, the results of the formative assessment are communicated through feedback to the learner. Formative assessments are not intended primarily to make judgments or decisions (though it can be a secondary gain).
Mastery	Exceeding the minimum level of competency to the proficient level of performance indicating rich experience with possession of great knowledge, skills, and attitude.
Portfolio	A collection of evidence of progression toward competency. It may include both constructed components (defined by mandatory continuous assessment tools in the curriculum) and unconstructed components (selected by the learner).

One45	One45 is a software program that was made available to all training programs by the SCFHS to facilitate managing the training process. One45 will help program directors to facilitate completing evaluations by trainers. The program director will be able to view/edit all evaluations before releasing the final evaluation to the trainees. Evaluation will be completed within two weeks of the rotation ending, therefore One45 will be facilitating evaluations for rotations in and accredited center by SCFHS exclusively. One45 will be able to complete evaluations and DOPS forms electronically. One45 will accommodate resident's personal pictures into their profile to make it easy for evaluator to reference. One45 will enable residents to send the DOPS form immediately after the session or procedure is done to the targeted trainers. Trainees will be enabled to evaluate both the faculty and the rotation to give feedback on the training process.
Summative assessment	An assessment that describes the composite performance of the development of a learner at a particular point in time and is used to inform supervisors' judgment and make decisions about the level of learning and certification.
Universal Topic	Knowledge, skills, or professional behavior that is not specific to the given specialty but is universal for the general practice of a given healthcare profession.

REFERENCES

1. Supported and endorsed by the Scientific Council for Cardiac Surgery Residency Training in the SCFHS.
2. Tekian AS, Al Ahwal MS. Aligning the SaudiMED framework with the National Commission for Academic Accreditation and Assessment domains. *Saudi Medical Journal*. 2015 Dec;36(12):1496. doi: 10.15537/smj.2015.12.12916.
3. Frank JR, Snell L, Sherbino J (eds.). *CanMEDS 2015 Physician Competency Framework*. Ottawa: Royal College of Physicians and Surgeons of Canada. 2015.
4. <https://www.acgme.org/What-We-Do/Accreditation/Milestones/Overview>
5. Roth GA, Johnson C, Abajobir A, Abd-Allah F, Abera SF, Abyu G, Ahmed M, Aksut B, Alam T, Alam K, Alla F. Global, regional, and national burden of cardiovascular diseases for 10 causes, 1990 to 2015. *Journal of the American College of Cardiology*. 2017 Jun 26; 70(1):1–25.
6. Ibid.
7. Kingdom of Saudi Arabia, Ministry of Health. *Health Statistical Year Book, 2015*.
8. Kingdom of Saudi Arabia, Ministry of Health. *Health Statistical Year Book, 2018*.
9. General Medical Council (Great Britain). *Good medical practice*. London: General Medical Council; 2006
10. Royal College of Physicians and Surgeons of Canada. *CanMEDS 2000: Extract from the CanMEDS 2000 Project Societal Needs Working Group Report*. *Med Teach*. 2000;22(6):549-54.
11. Accreditation Council for Graduate Medical Education. *General competencies*. In: *Outcome project*. Chicago: ACGME; 2007.
12. Simpson JG, Furnace J, Crosby J et al. The Scottish doctor—Learning outcomes for the medical undergraduate in Scotland: A foundation for competent and reflective practitioners. *Med Teach* 2002; 24: 136–43.
13. Spady W. *Outcome-Based Education*. Australian Curriculum Studies Association, 1993.
14. Harden RM, Crosby JR, Davis MH et al. AMEE Guide No. 14: Outcome-based education: Part 5—From competency to meta-competency: A model for the specification of learning outcomes. *Med Teach* 1999; 21: 546–52.
15. *Ann R Coll Surg Engl (Suppl)* 2007; 89: 342–345.