



الهيئة السعودية للتخصصات الصحية
Saudi Commission for Health Specialties

Adult Interventional Cardiology



سَبَّحَ لِلَّهِ الْمَدِينَةُ

PREFACE

💡 Advice for Fellows

- The Saudi Commission for Health Specialties Interventional Cardiology Fellowship program is a 1-year structured program. Clinical excellence, hands-on experience, and research are the integral pillars of this fellowship program.
- The goal of the program is to educate and train interventional fellows so that they develop into highly skilled and capable interventional cardiologists.
- This manual is meant as a guide to support fellows during this 1-year journey.
- The program provides clinical opportunities, including a comprehensive depth and breadth of procedures under the direct supervision of full-time interventional cardiologists, so that the fellows become proficient in all percutaneous coronary intervention devices and techniques by the end of the year-long fellowship.
- Fellow involvement in both pre-and post-procedure care, including the inpatient consultative and outpatient ambulatory services, completes the compressive fellowship training.
- The program also develops a strong sense of scientific curiosity and teaching with regularly scheduled educational activities, including case presentations and journal clubs. In addition, fellows participate actively in clinical research, including clinical trials, case reports, case series, and original research.

- The program is committed to providing extremely close mentorship, focusing both on personal and professional growth and well-being of interventional fellows and assisting in career choices and placement at the end of the year.



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We would also like to acknowledge that the CanMEDS framework is a copyright of the Royal College of Physicians and Surgeons of Canada, and many of the description's competencies have been acquired from their resources (Please refer to: CanMEDS 2015 physician competency framework; Frank JR, Snell L, Sherbino J, editors. CanMEDS 2015 Physician Competency Framework. Ottawa: Royal College of Physicians and Surgeons of Canada; 2015.).

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IV. INTRODUCTION

Cardiovascular diseases (CVDs) are the leading causes of death globally, accounting for an estimated 17.9 million deaths yearly. More than four out of five CVD deaths are due to heart attack and stroke, and one-third of these deaths occur prematurely in people under 70 years of ageⁱ. The population of Saudi is growing, and the incidence of diabetes is very high in our country besides smoking, a very strong risk factor for coronary artery diseaseⁱⁱ. Our leaders in Saudi Arabia have established multiple cardiac catheterization laboratories to treat patients who need coronary intervention, but we still do not have enough manpower to provide the needed services, due to high demand.

This highlights the importance of having a well-structured training program and a high level of professionally trained physicians with solid knowledge and clinical skills for serving human beings, saving lives, and improving their quality of life.

The interventional cardiology program is a 1-year program that will be conducted as part of Saudi Commission Health Specialties (SCFHS)-accredited programs. This program includes 1 year that will be spent in the cardiac catheterization laboratory, along with a 1-month vacation. The fellows are expected to be proficient and totally independent operators in percutaneous coronary intervention by the end of the yearⁱⁱⁱ.

Fellowship functions as a continuous educational component of the cardiology subspecialty. During the year of training, fellows are expected to master the clinical and technical aspects of coronary intervention while developing perspectives on procedural risk and benefit, patient selection, and clinical decision-making in cardiovascular patient care. At the end of

the year, the fellows should work as independent operators during procedures^{iv}.

The program provides clinical opportunities for consultant cardiologists, including comprehensive depth and breadth of clinical procedures under the direct supervision of interventional cardiology consultants, so that fellows become proficient in all requisite devices and techniques by the end of the year-long training. Moreover, fellow involvement in both pre- and post-procedure care, including inpatient consultative and outpatient ambulatory services, completes the compressive training.

The program also develops a strong sense of scientific inquiry and teaching with regularly scheduled educational activities based on scientific evidence-based medicine, including case presentations and journal clubs. In addition, the fellows actively participate in clinical research, including clinical trials, case reports, case series, and original studies.

The program is committed to providing extremely close mentorship, focusing on both the personal and professional growth and well-being of interventional fellows, and assisting in career choices and placement at the end of the year.

At the end of the training, fellows will be competent to practise as independent operators in the field of interventional cardiology and will have achieved competency in medical knowledge, patient care, professionalism, and interpersonal and communication skills^v. They will be leaders in the centers they serve, and they will be a great asset to the next generation of cardiologists as well as to the community. Ultimately, they will be integral parts of the achievement of the 2030 vision of our great country, the Kingdom of Saudi Arabia.



V. ABBREVIATIONS USED IN THIS DOCUMENT

Abbreviation	Description
SCFHS	Saudi Commission for Health Specialties
PT	Progress test
OSCE	Objective Structured Clinical Examination
OSPE	Objective Structured Practical Examination
Mini-CEX	Mini-Clinical Experience report
DOPS	Direct Observation of Procedural Skills report
CBD	Case-Based Discussion report
CBE	Competency-Based Education
ITER	In-Training Evaluation Report
COT	Consultation Observation Tool
FTC	Fellowship Training Committee
PCI	Percutaneous coronary intervention
CVDs	Cardiovascular diseases
DAPT	Dual antiplatelet therapy
ACS	Acute coronary syndrome
UA	Unstable angina
NSTEMI	Non-ST elevation myocardial infarction
STEMI	ST elevation myocardial infarction

VI. PROGRAM ENTRY REQUIREMENTS

- 1- To be board certified in an internal medicine program accredited by the SCFHS.
- 2- Completion of a cardiology fellowship program accredited by the SCFHS.

For any updates on the program requirements, please refer to the SCFHS website.



VII. LEARNING AND COMPETENCIES

The interventional cardiology fellowship rotation is only one rotation, which is dedicated to the work in the cardiac catheterization laboratory. The fellow will be involved in preparing the patient to be ready for the procedure, perform the procedure under the direct supervision of the consultant, follow up the patient post-procedure, and achieve what is required from the fellow. The following are the main objectives:

The fellow will be able to:

- 1) Perform basic and advanced coronary angiography competently.
- 2) Perform basic and advanced hemodynamic assessment for complex disease states, including right and left heart catheterization.
- 3) Demonstrate clinical knowledge necessary to diagnose and manage the breadth of cardiovascular conditions observed in invasive cardiology practice, including valvular, myocardial, coronary, vascular, and pericardial conditions.
- 4) Demonstrate technical skills in interventional techniques, including angioplasty by radial and femoral approach, stent placement intravascular ultrasound, fractional flow reserve, and optical coherence tomography.
- 5) Differentiate between normal and abnormal physiology as it pertains to cardiac catheterization.
- 6) Conduct and participate in clinical research related to cardiovascular medicine.

- 7) Communicate effectively and demonstrate interpersonal skills, including procedure-related discussions with patients and families as well as physician colleagues.
- 8) Communicate effectively in formal teaching sessions by preparing teaching materials and speaking formally to small and large groups.
- 9) Communicate and collaborate effectively within a multidisciplinary team toward comprehensive and compassionate patient care.
- 10) Demonstrate progressive improvement in clinical and technical skills, with increasing responsibility under appropriate supervision, to ultimately function as an independent operator trained in all aspects of interventional cardiology with the commitment and ability to provide compassionate, professional, and comprehensive care.

Milestones:

- Perform coronary angiography under direct supervision
- Perform coronary angiography under indirect supervision
- Perform coronary angiography independently
- Perform percutaneous coronary intervention under direct supervision
- Perform percutaneous coronary intervention under indirect supervision
- Perform percutaneous coronary intervention independently

2. Program Duration

One year (12 months) program

3. Program Rotations

- All 11 months must be spent in the invasive cardiology cardiac catheterization laboratory.
- One month vacation.



VIII. TEACHING METHODS:

Fellows are expected to be active participants in the pre-procedure assessment of the patient. The fellow must review and assess the indication for the procedure and whether the timing is correct for the said procedure. Your involvement in the pre-procedural assessment is of paramount importance.

Fellows are expected to play a primary role in performing the procedure. As training progresses, the involvement of the consultant should be supervisory in nature, directly or indirectly (i.e., scrubbed in the procedure vs. available in the control room).

Fellows are expected to be responsible for the post-procedural aspects of care, including writing a thorough report, post-procedure orders/plan, sheath removal and management, and anticipation and management of immediate post-procedural complications.

Fellows are expected to be active participants in journal clubs, clinical/practical teaching, heart-team meetings, and M&M discussions. A minimum of one weekly session on didactic knowledge must be included in the curriculum. Additionally, fellows were encouraged to participate in local and regional scientific meetings.

Program-Specific Learning Activities:

A) Interventional Cardiology Fellows Academic Activities:

Academic activities are arranged by the SCFHS Interventional Cardiology Committee. This monthly event covered core teaching concepts using a case-based approach. All fellows enrolled in the SCFHS Interventional Cardiology Fellowship Program were expected to

participate in the study. In addition, the structure of the teaching program allows fellows to be active participants through shared learning and leading/moderating the presentation. Attendance in academic activities is mandatory, and if the fellow is unable to attend, he or she is expected to communicate their absence to the program director.

Example of academic activity schedule during the fellowship

	Topic	Presenter	Hospital
26 th of May	Access / radiation safety	Alturki/ Khan	KFMC
27 th of June 7-9PM	/PCI tool /kit cases	Alzuayed/ almasood	KFSHRC
25 th of July 7-9PM	/LM, Ostial Lesions cases		PSCC
29 th of August 7-9PM	/CTO, Bifurcation cases		KAMC
26 th of September 7-9PM	/ Physiology and Imaging cases		PSCC
31 th of October 7-9PM	STEMI /thrombotic lesions/ and cases		KSMC
28 th of November 7-9PM	PCI post CABG and diffuse disease / cases		KFMC
26 th of December 7-9PM	Complication/ cases		KFSHRC



B) Practice-Based Learning:

Each training center has a unique way of conducting the “heart-team” meeting. Regardless of the way its conducted, the core concepts remain the same; that is assigning the best therapeutic course to a particular patient. The fellows are expected to be active participants in heart team meetings, voice their opinions, and learn from opposing opinions.

C) Research:

Fellows are expected to complete at least one supervised research project or quality improvement (QI) project. This should be discussed with the program director early in the academic year and monitored at quarterly program director meetings. Participation in the research can be in the form of joining an existing program (e.g., registries, clinical trials, and retrospective reviews) or starting a novice program (e.g., measuring radiation doses using different approved techniques). Involvement in such programs will enhance fellows’ abilities to better understand the researched subject and enable them to contribute towards advancing scientific growth in the field.

IX. ASSESSMENT AND EVALUATION

1. Purpose of Assessment

Assessments play a vital role in the success of postgraduate training. Assessment guides trainees and trainers to achieve defined standards, learning outcomes, and competencies.

- a. **Assessment for learning:** Quarterly written and verbal assessments must be conducted and reviewed by the fellow and the interventional cardiology committee.
- b. **Assessment as learning:** Fellows should be able to undergo continuous self-assessments, results of which should be communicated to all educators. Interventional cardiology fellows represent the epidemic of the adult learner and must continue to participate in the continuous “self-assessment” method to identify what was done properly and what needs to be improved. As training progresses, fellows are expected to reflect on which parts of the procedure they can master and in which they are still barely competent. This self-reflection should be a continuous process for each fellow, and they should be strongly encouraged to communicate with their educators.
- c. **Assessment of learning:** This a competency-based section that addresses various steps in the core procedures and the following sections:



Step	Unsatisfactory	Competent	Excellent
Pre-procedural assessment			
Indications/appropriate use			
Clinical assessment			
Informed consent			
Time out/patient safety			
Coronary angiography			
Vascular Access			
Ultrasound use			
Equipment selection			
Catheter manipulation			
Coronary angiogram Interpretation			
Knowledge in hemodynamics			
Thoughtful planning post angiography “decision-making”			
PCI			
Equipment selection			
Wiring			
Handling balloons and stents			
Knowledge in Pharmacology			
Intravascular imaging			
Plaque modification			
Physiological assessment			

Step	Unsatisfactory	Competent	Excellent
Vascular closure			
Radiation safety			
Postprocedural assessment			
Medical management post PCI			
Follow up			
Complications management			

d. Feedback and evaluation

Trainees, as adult learners, should strive to seek and develop their performance based on feedback throughout their journey of competency from “novice” to “mastery” levels. Trainees are strongly encouraged to seek feedback; trainers are expected to provide immediate feedback during the day and equally important and face-to-face “delayed” feedback that is separate from procedural teaching to emphasize and highlight what was done correctly and what needs improvement.

2. Formative Assessment:

Feedback should be comprehensive (knowledge, skills, and attitude), encompass multiple sources (or 360 evaluations), be relevant, and be focused on direct observation. An interventional fellow must be an integral part of the flow in the catheterization laboratory, and any person performing such a role should be exposed to opportunities for self-improvement. This should be identified and delineated according to Miller’s pyramid.

Additionally, feedback should be milestone-oriented and fellow-specific. For instance, it is expected that 90% vascular access will be achieved independently by the end of the month.



Formative Assessment Tools

Learning Domain	Formative Assessment Tools	Notes
Knowledge	<ul style="list-style-type: none"> - Structured Academic Activities - <i>Heart team meeting discussion</i> 	<ul style="list-style-type: none"> - Once/week - At least once/week
Skills	<ul style="list-style-type: none"> - Logbook - DOPS: Direct Observation for Procedural Skills - Research Activities 	<ul style="list-style-type: none"> - Logbook progress will be reviewed every 4 months. - Program directors are expected to complete DOPS periodically with the fellow. - research evaluation/4months
Attitude	ITER: In-Training Evaluation Report	<ul style="list-style-type: none"> - To be done quarterly. Must include evaluation from all educators. - Written and signed by interventional cardiology fellow

The evaluation of each component will be based on the following equation:

Percentage	< 50%	50–59.4%	60–69.4%	> 70%
Description	Clear fail	Borderline fail	Borderline pass	Clear pass

To achieve unconditioned promotion, the candidate must score a minimum of “borderline pass” in all used formative assessment tools.

- The program director can still recommend the promotion of candidates if the above criteria are not met in certain situations.
- In case the candidate scored “borderline failure” in a maximum of one or two components, these scores should not belong to the same area of assessment (for example, both borderline failures should not belong to both skills)
- The candidate must have passed all other components and scored a minimum clear pass in at least two components.

Final In-training Evaluation Report

In addition to approval of the completion of clinical requirements (250 PCI and 12 months rotation in the catheterization laboratory) by the supervising committee, the final in-training evaluation report (FITER) is also prepared by program directors for each fellow at the end of his or her year of training. This report will be the basis for obtaining a Certificate of Training Program Completion, and is the qualification criterion to sit for the final exams.

Certification of Training Completion

In order to be eligible to sit for final specialty examinations, each trainee is required to obtain “*Certification of Training Completion.*” Based on the General Bylaws of Training in Postgraduate Programs and executive policy (please refer to www.scfhs.org), trainees will be granted “Certification of Training-Completion” once the following criteria are fulfilled:

- Successful completion of 12 months in the catheterization laboratory.
- Completion of 250 PCI.
- Completion of FITER approved by the scientific committee of interventional cardiology.
- Clearance from the SCFHS training affairs.



The Certification of Training Completion is issued and approved by the supervisory committee or its equivalent according to the SCFHS policies.

Final Examinations

The final examination for adult interventional cardiology grants trainee certification as an independent interventional cardiologist. The final test consisted of two components. Fellows are expected to pass both components to graduate.

- a) **Final written exam:** in order to be eligible for this exam, trainees are required to have obtained “Certification of Training Completion.”
- b) **Final clinical/practical exam:** Trainees are required to pass the final written exam to be eligible for the final clinical/practical exam.

Written Exam Blueprint:

No.	Sections	Percentage
1.	Acute coronary syndrome (STEMI, NSTEMI, and UA)	10%
2.	Chronic coronary artery disease	6%
3.	Indications /contraindication for both diagnostic and therapeutic coronary angiogram	7%
4.	Complication of coronary angiogram; both diagnostic and therapeutic	6%
5.	Cardiac catheterization laboratory/procedure safety	5%
6.	Vascular access; small and large bore	6%
7.	Primary PCI	10%

No.	Sections	Percentage
8.	Percutaneous coronary interventions; tools techniques and complications	20%
9.	Coronary intervention pharmacology	7%
10.	LV assist devices	4%
11.	Coronary lesion assessment, imaging and physiology	6%
12.	CAD risk factors /prevention	6%
13.	Percutaneous coronary intervention updates	7%
Total		100%

Note:

The blueprint distribution of the examination may differ by up to +/-5% in each category.

ACS management:

STEMI

- o Primary PCI
- o Fibrinolytic therapy
- o Rescue PCI
- o High Clot Burden/
- o Late presentation
- o Cardiogenic shock
- o Cardiac Arrest
- o Aortic dissection
- o Mechanical complications
- o Non-culprit disease

NSTEMI

- o Multivessel disease
- o Invasive vs non-invasive management
- o Pharmacology
- o Physiological assessment
- o Intravascular imaging
- o Vulnerable plaque
- o Physiological assessment

CCS Management:

- Knowledge of non-invasive assessment
- Indications for invasive assessment
- Medical management
- Outcomes post PCI

Coronary angiography:

- Indications
- Interpretations
- What is next?
- Anomalies
- Complications

PCI:

- Indications
- Strategy
- Lesion types and details and their clinical implications
- Medical Decision Making (approach to patients with CAD)
- Heart Team
- Multivessel disease
- Plaque modification

- Intravascular imaging
- Complications (acute vessel closure, dissection, and perforation)
- Troubleshooting – Example: uncrossable lesion, undilatable lesion

Vascular Access:

- Radial vs Femoral
- Complications
- Closure devices

Hemodynamics:

- Right Heart Catheterization
- Valvular assessment
- Arterial/ventricular waveforms

Complications management:

- Transvenous pacing
- Unstable arrhythmias
- Embolisms
- Pericardiocentesis

Pharmacology:

- Antiplatelet therapy
- DAPT (dual antiplatelet therapy) duration
- Anticoagulation
- Inotropes
- Vasopressors
- Antiproliferative agents
- Contrast media



Physics:

- Radiation safety
- Imaging technique and acquisition

Informed Consent:

- Estimation of risk
- Patients' autonomy and privacy
- Delineation of alternative therapies

Learning Domain	Summative Assessment Tools	Passing Score
Knowledge	<ul style="list-style-type: none">- Final Written Examination	At least borderline pass in each tool in accordance with the standard setting method used by the executive administration of assessment
Skills	<ul style="list-style-type: none">- Objective Structured Clinical Examinations (OSCE)	At least borderline pass in each tool in accordance with the standard setting method used by the executive administration of assessment
Attitude	FITER: In-Training Evaluation Report	Successfully pass FITER

X. PROGRAM AND COURSE EVALUATION

The SCFHS applies various measures to evaluate the implementation of this curriculum. The training outcomes of this programme will follow the quality assurance framework endorsed by the Central Training Committee of the SCFHS. Trainee assessment (both formative and summative) results are analyzed and mapped to the curriculum content. Other indicators that will be incorporated are as follows:

- Report of the annual trainees' satisfaction survey.
- Reports from trainees' evaluation of faculty members.
- Reports from trainees' evaluation of rotations.
- Reports from the annual survey of program directors.
- Data available from program accreditations.
- Reports from direct field communications with trainees and trainers.

Goal-Based Evaluation: The achievement of intended milestones will be evaluated at the end of each stage to assess the progress of curriculum delivery, and any deficiencies will be addressed in the following stage, thereby utilizing the time devoted to trainee-selected topics and professional sessions.

In addition to subject-matter opinions and best practices from benchmarked international programs, the SCFHS will apply a robust method to ensure that this curriculum will utilize all data available during its revision in the future.



XI. POLICIES AND PROCEDURES

This curriculum represents the means and materials, and outlines the learning objectives with which trainees and trainers will interact to achieve the identified educational outcomes. The SCFHS has a full set of “General Bylaws of Training in Postgraduate Programs” and “Executive Policies” (published on the official SCFHS website) that regulates all training-related processes. The general bylaws of training, assessment, and accreditation as well as executive policies on admission, registration, formative assessment and promotion, examination, trainees’ representation and support, duty hours, and leaves are examples of regulations that need to be implemented. Under this curriculum, trainees, trainers, and supervisors must comply with the most updated bylaws and policies, which can be accessed online (via the official SCFHS website).

XII. APPENDICES

Appendix-A

External Didactic sessions:

Each fellowship program is expected to provide its own weekly didactic sessions. In addition, a monthly session will be conducted to cover all interventions in the Kingdom, which will be arranged by the educational committee for interventional cardiology.

Intent:

The educational committee for interventional cardiology will be made up of adult interventional cardiologists and will be responsible for creating and conducting parallel evening monthly educational didactic sessions that focus on the non-technical aspects of interventional cardiology, such as the psychological impact of procedures on physicians, ethical dilemmas in interventional cardiology, how to avoid bias and put patients' interests first, how to interact with industry, deal with physician burnout, and early career goals. These concepts were delivered as direct topics or through commentary and discussion.

Assessment:

These topics will be discussed in a follow-up fashion. A fellow student was paired with a mentor to supervise the presentation. At the end of each learning unit, there will be a discussion with additional consultants.



Appendix B

RESEARCH

MEDICAL EXPERT

Goals:

- To demonstrate the basic principles of research design, methodology, data analysis, and clinical epidemiology. These have both advantages and disadvantages from the perspective of interventional cardiology.
- Familiarize themselves with the ethical requirements of the research and demonstrate an understanding of the responsible use of informed consent.
- Implement appropriate methods for writing research proposals, manuscripts, data collection, and result analysis and discussion.
- To demonstrate awareness of current research topics in interventional cardiology using available medical informatics systems.
- To skillfully present scientific presentations and participate in public discussions.
- To learn how to apply scientific evidence to daily practice

Training Methods

- The fellows are expected to complete at least one project during the year of the interventional cardiology fellowship. This study may have included a QI project supervised by a consulting interventional cardiologist.

COMMUNICATOR

- Demonstrate skills in conveying and discussing scientific research with scientific communities through posters, abstracts, teaching slides, manuscripts, or other scientific communication modalities.
- Communicate and collaborate effectively with the research supervisor to conduct the research.

- Be able to present and discuss a controversial case by applying evidence-based medicine.

COLLABORATOR

- Identify, consult, and collaborate with appropriate experts, research institutions, and/or organizational bodies to facilitate research.

LEADER

- Identify an area of research interest and research supervisors for scientific inquiry and dissemination.
- Utilize available resources and regularly meet with an identified research mentor.
- Set realistic priorities and use time effectively to optimize professional performance.
- Utilize health care resources cost-effectively.

HEALTH ADVOCATE

- Recognize the contributions of scientific research towards improving the health of patients and communities.

SCHOLAR

- Pose appropriate research questions, recognize and identify gaps in knowledge and expertise, and formulate an appropriate study design to answer them.
- Carry out the research as outlined in the proposal.
- Collect and analyze data utilizing appropriate methods.
- Prepare abstracts and manuscripts suitable for publication in peer-reviewed journals and/or international scientific meetings.
- Identify research limitations and areas for further research.



PROFESSIONAL

- Ethical and professional research expectations were consistent with the institutional review board guidelines, including the maintenance of meticulous data and the conduct of ethical research.
- Demonstrates personal responsibility for setting research goals and working with supervisors to set and achieve research timeline objectives.
- Appropriately attribute authorship and contributions when publishing research
- Disclose potential financial conflicts of interest (including speaker fees and consultative relationships) when engaging in and disseminating research results.

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ⁱ <https://www.who.int/health-topics/cardiovascular-diseases/>

ⁱⁱ <https://pubmed.ncbi.nlm.nih.gov/29110860/>

ⁱⁱⁱ <https://medicine.vumc.org/interventional-cardiology-program>

^{iv} <https://www.houstonmethodist.org/education/medical/graduate-medical-education/interventional-cardiology-fellowship/>

^v <https://scai.org/education-and-events/fellows-training>

This reference is an example for the general outline of the CanMEDS competency (Frank JR, Snell L, Sherbino J, editors. CanMEDS 2015 Physician Competency Framework. Ottawa: Royal College of Physicians and Surgeons of Canada; 2015)

