الهيئة السعودية للتخصصات الصحية
Saudi Commission for Health Specialties

Radiology Technology and Medical Imaging in Computed Tomography


بسم الله الرحمن الرحيم

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We acknowledge that the CanMEDS framework is a copyrighted project of the Royal College of Physicians and Surgeons of Canada. Many of the descriptions and RT&MI competencies have been acquired from their resources.

ABBREVIATIONS

Abbreviation	Description
SBRT&MI	Saudi Board of Radiology Technology and Medical Imaging
SBRT&MI-CT	Saudi Board of Radiology Technology and Medical Imaging Computed Tomography
RT&MI	Radiology Technology & Medical Imaging
CT	Computed Tomography
MRI	Magnetic Resonance Imaging
US	Ultrasonography, Ultrasound
NM	Nuclear Medicine
MR	Magnetic Resonance
QI	Quality Improvement
CanMEDS	Canadian Medical Education Directives for Specialists
SCFHS	Saudi Commission for Health Specialties
KFMC	King Fahad Medical City
KSMC	King Saud Medical City
KAUH	King Abdulaziz University Hospital

Abbreviation	Description
GI	Gastrointestinal
IV	Intravenous
ECG	Work Electro cardiogram
PACS	Picture Archiving and Communication System
MCQ	Multiple-Choice Question
HCW	Healthcare Workers
RIS	Radiology Information System
QA	Quality Assurance
ITER	In-Training Evaluation Reports
FITER	Final In-Training Evaluation Report

TABLE OF CONTENTS

CONTRIBUTORS 3
COPYRIGHTS AND AMENDMENTS 4
ACKNOWLEDGMENTS 5
ABBREVIATIONS 6
TABLE OF CONTENTS 8
INTRODUCTION 11
TRAINING PROGRAM STRUCTURE 14
Objectives 14
Admission Requirements for Candidates 15
General Training Requirements 16
Contents of Training 16
Minimum Training Requirements for SBRT&MI Residents 19
Minimum Research Requirements for SBRT&MI Residents 20
VACATION AND CONFERENCE LEAVES 21
SPECIFIC LEARNING OBJECTIVES AND COMPETENCIES 22
1. RT&MI expert: 22
2. Communicator: 28
3. Collaborator: 29
4. Manager: 32
5. Health Advocate: 33
6. Scholar: 35
Professional 36
TEACHING AND LEARNING ACTIVITIES 39
1) Formal Teaching and Learning Activities: 39
GENERAL X-RAY SECTION 41
Training Rotation 41
INTERVENTIONAL RADIOLOGY AND FLUOROSCOPY 46
Training Rotation 46
MAGNETIC RESONANCE IMAGING (MRI) 49
Training Program 49

NUCLEAR MEDICINE (NM)/POSITRON EMISSION TOMOGRAPHY (PET) IMAGING 51
Training Program 51
COMPUTER TOMOGRAPHY (CT) 53
Training Program 53
ULTRASOUND (US) 58
Training Program 58
Universal Topics (10%) 59
2) Practice-Based Learning 63
WORK-BASED LEARNING 65
Courses 65
Course Content 67
Radiation Physics—PART ONE (R2) 70
Magnetic Resonance Imaging (MRI) 70
Radiation Physics—PART TWO (R3 & R4) 71
OTHER COURSES 79
Quality Improvement (QI) 79
Specific Objectives: 81
Workshop 81
Self-Directed Learning 82
SUGGESTED REFERENCE BOOKS: 83
General books 83
CT books 83
X-ray books 84
MRI books 84
US books 85
NM books 85
Radiology learning websites 85
ASSESSMENT 86
1. Purpose of Assessment 86
2. Formative Assessment 86
3. Summative Assessment 95

EXAM BLUEPRINTS 98
Part One Exam Blueprint Outlines: 98
Promotion Exam Blueprint Outlines: 99
REFERENCES 103
APPENDICES 105
APPENDIX 1/logbook 105
APPENDIX 2 107
APPENDIX 3 113
APPENDIX 4 116
APPENDIX 5 118
APPENDIX 6 123
APPENDIX 7 126
APPENDIX 8 129
APPENDIX 9 132
APPENDIX 10 135
APPENDIX 11 142
APPENDIX 12 145
APPENDIX 13 146

INTRODUCTION

The goal of the Saudi Board of Radiology Technology and Medical Imaging (SBRT&MI) is to produce the best possible qualified technologists who can safely practice and meet the healthcare needs of society. This program was designed to help new graduates gradually improve their field-specific skills and achieve promotions to higher academic grades once they complete their courses.

Several countries in the Western World introduced fellowship programs for health science graduates. Some of these fellowship programs may take up to six years. For example, the Institute of Physics and Engineering in Medicine in the UK offers fellowships, which are designed for clinical scientists and clinical technologists. In the USA, several specialty boards exist, e.g., the American Board of Science in Nuclear Medicine. They provide a similar program.

The SBRT&MI program is unique and follows the Canadian Medical Education Directives for Specialists (CanMEDS) framework. The CanMEDS framework has been applied to postgraduate training programs in many countries. It offers a competency model that places emphasis not only on Radiology Technology & Medical Imaging (RT&MI) expertise but also on multiple additional non-RT&MI expert roles that competently address the healthcare needs of society. The Saudi Commission for Health Specialties (SCFHS) has adopted the CanMEDS framework to establish a core curriculum for all training programs. RT&MI residents will function in seven CanMEDS roles: RT&MI experts, communicators, collaborators, managers, health advocates, scholars, and professionals.

The SBRT&MI program consists of four years of full-time supervised residency training in RT&MI and related fields. The training institution must be accredited by the SCFHS to offer the SBRT&MI program. The RT&MI residents will benefit from comprehensive training and be actively involved in patient care. Their responsibilities will increase with increasing experience and competency. The rules and regulations of the training program should be followed.

Upon successful completion of the training program, RT&MI residents will be awarded the “Saudi Board in RT&MI” qualification. At this stage, they will

have a degree of competency and experience considered adequate for the practice of clinical radiographic technology and will become eligible for positions in radiology departments as technical consultants after fulfilling the requisite years of experience demanded by the SCFHS. Residents will be consulted regarding exam selection and postprocessing, education of residents and staff, research on the development of new methods for protocol optimization, and implementation of quality patient care.

The SBRT&MI program was designed to cover Four major areas in RT&MI that exhibit the highest demand:

1. Computed tomography (CT);
2. Magnetic resonance imaging (MRI);
3. Ultrasonography (US);
4. Nuclear medicine (NM).

The program includes both theoretical and practical parts to introduce candidates for advanced techniques in each proposed specialty. The first part (first and second years) of the program covers generic, basic, and overall knowledge and understanding of RT&MI modalities of cross-sectional imaging, such as general X-ray, angiography, fluoroscopy, NM, US, and CT, and MRI. Furthermore, all techniques and relevant physics are included. The second part (third and fourth years) is dedicated to one of the specialties (NM, US, CT, or MRI).

The purpose of this curriculum is to define the training process and competencies required for the SBRT&MI certification. After training, the RT&MI specialists will be able to work as senior technologists in the RT&MI departments and will be promoted to consultant technologists after three years of experience. This curriculum will be reviewed every four years or whenever necessary. All trainees who completed the program satisfactorily are eligible for the SBRT&MI examination Part 2.

TRAINING PROGRAM STRUCTURE

The SBRT&MI-CT program is a four-year full-time residency program in accredited institutions. The program comprises training for acquiring cognitive and technical skills and understanding how they relate to patient care, safety, physics, applied anatomy, pathology, and the physiology of health and diseases. The training involves practical procedures and interpretation methods taught sequentially and integrated manner through lectures, tutorials, seminars, and hands-on experience.

Objectives

The objective is to guide RT&MI residents through a well-structured comprehensive training program certified by the SCFHS in clinical RT&MI. After successfully completing the training and final certification exam, graduates will be independent first specialists in the RT&MI fields.

The SBRT&MI-CT program prepares residents to:

- Plan and provide both routine and complex RT&MI care for various patients by applying advanced knowledge and clinical skills;
- Acquire competencies and confidence in various RT&MI exams;
- Reinforce the ability to interpret submitted RT&MI exams accurately and efficiently with the best image quality using effective protocols;
- Keep up-to-date with modern technology regarding RT&MI;
- Communicate, understand, and function effectively with other healthcare professionals and understand their organizational systems;
- Acquire experience in teaching and research to upgrade clinical knowledge. At the end of the program, RT&MI residents will have acquired CanMEDS framework competencies and can function effectively in the following roles:
    - Radiology and Medical Imaging experts
    - communicator,
    - collaborator,
    - leader,

- health advocate,
- scholar,
- professional.

Admission Requirements for Candidates

Please refer to the updated executive policy of SCFHS on admission and registration.
Website: www.scfhs.org.sa

General Training Requirements

- RT&MI residents shall obey the training regulations and obligations established by the SCFHS and their training centers.
- RT&MI residents should be enrolled in full-time continuous education for the entire program.
- Training is to be conducted in institutions accredited by the SCFHS.
- Training should be comprehensive and include general clinical education in the first part and specialized education in US, NM, CT or MRI in the second part.
- RT&MI residents should be actively involved in examination requests, taking of patient histories, and clinical examinations to achieve diagnoses, with gradually increasing responsibility regarding clinical and technical aspects.

Contents of Training

First Year (R1)

The first year of training consists of six months of rotation for general X-ray, two months for angiography, and four months for fluoroscopy. The rotations introduce RT&MI residents to areas of general imaging, which can entail performing routine examinations and on-call duties. During this time, residents will receive training in the necessary radiological examinations of the aforementioned specialties.

Key components of the introductory phase are the basics of picture archiving and communication systems (PACS), image manipulation, and communication skills.

Students should concentrate on mastering the basics, including PACS, radiology information system, imaging-based anatomy, imaging physics, radiation safety, contrast administration, and all related issues, with a focus on general radiography, angiography, fluoroscopy, and radiographic techniques during their respective rotations.

Second Year (R2)

The second year of this program concentrates on intensifying the knowledge

and technical experience of RT&MI residents regarding the physics of cross-sectional imaging (CT and MRI), US, and NM. RT&MI residents are also introduced to specific pediatric imaging techniques that help them acquire the necessary skills to serve the population. Moreover, RT&MI residents are introduced to breast imaging.

During the second year, the RT&MI residents are encouraged to enroll in courses to conduct research and evidence-based medical imaging courses. These will prepare the residents for the research project in the following year.

The typical rotation program of the second year, including hands-on scanning of patients, is asfollows:

- three months: physics and general US procedures;
- three months: physics and general MRI procedures;
- three months: physics and general CT procedures;
- three months: physics and general NM procedures.

Third Year (R3)

The third year includes rotations with hands-on training in CT field.

The third year also introduced residents to more detailed physics and imaging. The learning period consisted of a comprehensive rotation program wherein the residents work closely with senior technologists and radiologists, covering basic and advanced imaging procedures.

Moreover, RT&MI residents dedicate two weeks to research and quality improvements. They are given the opportunity to either conduct a research project under faculty supervision to produce publishable material or to undertake a departmental quality improvement project. There are two weeks during R3 during which residents can choose education program. If desired, they can attend local or international medical imaging courses.

The typical rotation program is as follows:

- two weeks: research, quality courses, and rotation;
- two weeks: medical-imaging courses and conferences;
- eleven months: rotation in CT field.

Fourth Year (R4)

In the fourth year, advanced rotations were offered in one of the fields chosen by the RT&MI residentin R3. The fourth year is intended to deepen the skills of senior RT&MI residents and serve as a foundation for reviewing

content relevant to examination and certification purposes. This year encourages RT&MI residents to tailor their rotation programs to areas that best suit their personal learning objectives and career directions. This flexibility is implemented by offering two months of elective rotations in advanced imaging or a chosen subspecialty.

These rotations consolidate technical and clinical skills in a single medical imaging modality. They permit graded responsibilities and independent scanning under staff supervision. During these months, the senior RT&MI resident aims to perform the responsibilities and carry the workload of a junior staff technologist. The review of the core materials for exam preparation through on-the-job exposure to important aspects of imaging modalities is advocated.

Furthermore, the fourth year begins with exposure to advanced imaging during rotation. RT&MI residents are expected to familiarize themselves with advanced physics and the technical aspects of the chosen imaging modality, including imaging protocols, indications, contraindications, patient preparation, and image interpretation.

The rotation design for the fourth year includes ten-month rotations in one of the modalities chosen by the RT&MI resident in R3. The year offers two months of elective subspecialty rotations that can be performed anytime with the approval of the program director.

R4 RT&MI residents should supervise and teach junior residents, and start conducting clinical–radiological meetings under staff supervision.

Minimum Training Requirements for SBRT&MI Residents

The SCFHS requires four years of training and completion of the allocated requirements foreligibility to participate in the SBRT&MI-CT examination:

- clinical rotations,
- research activities,
- participation in teaching activities.

Furthermore, RT&MI residents should rotate between multiple training centers during theirresidency.

Minimum Research Requirements for SBRT&MI Residents

During the second part of the program (third and fourth years), RT&MI residents will be trained as clinical researchers with in-depth knowledge of statistical and analytical skills regarding population-based clinical studies or research outcomes. The guiding principle of clinical research education is to teach RT&MI residents to perform clinical research projects under mentorship.

The RT&MI resident must have a research mentor. The research mentorwill be selected by the RT&MI resident but must be approved by the director of the SBRT&MI program. Furthermore, RT&MI residents must submit a written research proposal that will be reviewed by the committee of the SBRT&MI program.

The RT&MI residents are expected to complete **one** of the following research activities duringtheir educational programs:

- Submit a case report for presentation at a local or international specialty conference.
- Write a review paper as first author;
- Conduct an original research project. The results are expected to be presented as an abstract at a scientific meeting and published in a peer-reviewed journal.

The RT&MI residents will have covered most of the knowledge-based research objectives bythe end of the fourth year.

SPECIFIC LEARNING OBJECTIVES AND COMPETENCIES

1. RT&MI expert:

Definition:

As RT&MI experts, RT&MI residents assume all CanMEDS roles, applying RT&MI knowledge, clinical skills, and professional attitudes to provide patient-centered care. Being an RT&MI expert is the central role of technologists educated in the CanMEDS framework.

Elements:

- Integration and application of all CanMEDS roles for patient care;
- Recognize basic and advanced radiological anatomy;
- Understand the basic and advanced physical principles behind radiological techniques;
- Understand basic and advanced imaging techniques and technical problem-solving approaches;
- Learn the indications and absolute and relative contraindications for various contrast media;
- Recognize the appropriate indications and contraindications of various radiological techniques;
- Recognize and manage radiological emergency procedures and common pathologies;
- List the most important differential diagnoses for various imaging findings;
- Recognize unusual imaging presentations of common pathologies;
- Understand postprocessing, image manipulation, and protocol optimization;
- Understand rules of health informatics in radiology and optimal PACS utilization;

- Application of ethical principles for patient care;
- Respect principles of patient safety and avoid adverse events.

Key and Enabling Competencies:

RT&MI residents can:

1. Function effectively as RT&MI residents and comprise all CanMEDS roles to provide optimal, ethical, and patient-centered medical care:
    - Effectively perform radiological procedures and case discussions including assessments, diagnoses, and recommendations in written and/or verbal form;
    - Demonstrate effective use of all CanMEDS competencies relevant to RT&MI;
    - Identify and respond appropriately to relevant ethical issues arising in patient care;
    - Prioritize professional duties appropriately and effectively when facing multiple patients and problems;
    - Demonstrate compassionate patient-centered care.
2. Establish and maintain clinical and technical radiological knowledge, skills, and attitudes appropriate for RT&MI:
    - Apply knowledge of clinical, sociobehavioral, and fundamental biomedical sciences relevant to RT&MI specialties, including:

- The characteristics of all RT&MI types, including but not limited to physical and technical aspects, patient positioning, and the use of contrast media;
- The theoretical, practical, and legal aspects of radiation safety including but not limited to alternative imaging techniques and their possible harmful side effects;
- Human anatomy at all ages, both conventional and multiplanar, with an emphasis on imaging applications
- All aspects of RT&MI, including but not limited to normal anatomical variants and disease processes, factors affecting the interpretation of imaging and differential diagnoses, correlation of imaging with pathology, and complications, including but not limited to contrast media reactions. This includes the appropriate application of general X-ray, fluoroscopy, US, CT, MRI, NM, and other imaging modalities, as well as interventional procedures relevant to imaging the:
  - Abdominal/pelvic area
  - Gastrointestinal (GI) system
  - Hepato–pancreatic–biliary system
  - Renal and urinary tract
  - Male reproductive system
  - Spleen, lymphatic system, and bone marrow
  - Retroperitoneum
  - Chest (cardiac imaging)
  - Air spaces
  - Airways
  - Interstitium
  - Mediastinum, including but not limited to great vessels and esophagus
  - Pleura
  - Heart and pericardium
  - Chest wall
  - Head and neck
  - Nose, sinuses, and facial bones
  - Orbits
  - Temporal bone, cerebellopontine angle, and skull base

- Larynx, hypopharynx, and trachea
- Oral cavity and pharyngeal mucosal space
- Submandibular space
- Carotid space
- Masticator space
- Retropharyngeal space and prevertebral space
- Parotid gland, thyroid gland, and esophagus
- Dental and maxillofacial region
- Brain
- Pituitary and parasellar region
- Skull
- Spinal cord and related structures, including but not limited to peripheral nerves
- Cranial nerves
- Intracranial and extracranial cerebral vessels
- Musculoskeletal imaging
- Shoulder, clavicle, and upper arm
- Elbow and forearm
- Hand and wrist
- Pelvis, hip, and thigh
- Knee and leg
- Ankle and foot
- Spine
- Bone
- Development
- Marrow
- Peripheral nerves
- Breast
- Malignant diseases
- Benign diseases
- Gynecological imaging
- Ovaries
- Non-ovarian adnexa

- Non-pregnant uterus and cervix
- Endometrium
- Vagina and labia
- Obstetrical imaging
- Uterus, placenta, cord, and adnexa
- Fetus
- Pediatric area
- Head, neck, and spine
- Chest/cardiac system
- Musculoskeletal system
- Abdomen and pelvis
- Vascular and interventional radiology
- Lymphatic system
- Cardiac system
- Arterial and venous vascular systems
- Abdominal area
- Chest and neck
- Peripheral area
- Interventional procedures
- Upper and lower urinary system
- GI system
- Hepatobiliary system
- Respiratory system
- Musculoskeletal system.

• Describe the CanMEDS framework for competencies relevant to the RT&MI specialties;
• Obtain lifelong relevant learning skills, implement a personal program to remain abreastof current issues, and enhance areas of professional competency;
• Contribute to enhancing quality care and patient safety byintegrating the best practices available in RT&MI.

3. Perform complete and appropriate assessment of patients before, during, andafter radiological procedures:

- Effectively identify and explore issues requiring attention by including patient preferences and the context of their complaints;
- Perform focused physical examinations to ensure safety, prevention, diagnosis, and/or management;
- Select medically appropriate radiological procedures in a resource-effective and ethical manner to ensure medical exams with minimized exposure to contrast agents and radiation. This is particularly important for pregnant and pediatric patients, those of childbearing age, and medically compromised patients;
- Demonstrate effective clinical and technical problem-solving skills and judgment.

4. Use radiological diagnostic procedures effectively:
   - Implement effective radiological diagnostic procedures in collaboration with patients and their families;
   - Demonstrate effective, appropriate, and timely applications of radiological diagnostic procedures relevant to RT&MI practice;
   - Demonstrate knowledge of acceptable and expected results of investigations and/or interventions as well as unacceptable and unexpected results. This includes the knowledge of and ability to manage radiological-imaging-related complications;
   - Ensure that appropriate informed consent is obtained for radiological imaging procedures;
   - Ensure that patients receive appropriate end-of-life care.
5. Demonstrate proficient and appropriate use of radiological-imaging-procedure skills:
   - Demonstrate effective, appropriate, and timely performance of relevant radiological imaging procedures;
   - Ensure that appropriate informed consent is obtained for procedures;
   - Demonstrate appropriate documentation and dissemination of information related to the procedures performed and their outcomes.
6. Seek appropriate consultations from other health professionals and recognize the limitations of their expertise:
   - Demonstrate insights into the limitations of one's expertise via self-assessment;

- Seek and include the knowledge of another health professional, if required, for effective, appropriate, and timely consultations to achieve optimal patient care.

2. Communicator:

Definition:

As communicators, RT&MI residents can form appropriate relationships with patients and their families to facilitate the gathering and sharing of essential information for carrying out effective radiological imaging procedures.

Elements:

- Patient-centered approach to communication;
- Rapport, trust, and ethics;
- Build satisfying relationships with patients, their families, and caregivers;
- Shared decision-making;
- Mutual understanding;
- Elicit and synthesize information for patient care;
- Convey effective oral and written information for patient care;
- Use of verbal and nonverbal professional communication.

Key and Enabling Competencies:

RT&MI residents can:

1. Develop professional relationships with patients and their families:
    - Recognize that being a good communicator is a core clinical skill for RT&MI residents, and effective communication can foster patient satisfaction, adherence to treatment plans, and improved clinical outcomes;
    - Establish positive relationships, characterized by understanding, trust, respect, honesty, and empathy with patients and their families;
    - Respect patient confidentiality, privacy, and autonomy;
    - Be aware of and responsive to nonverbal cues.

2. Accurately obtain and synthesize relevant information and the perspectives of patients, their families, colleagues, and other professionals:
    - Seek and synthesize relevant information from other sources such as the families of patients, caregivers, and other professionals.
3. Accurately convey relevant information and explanations to patients, their families, colleagues, and other professionals:
    - Deliver information to patients, their families, colleagues, and other professionals humane and understandable manner, encouraging discussion and participation in decision-making.
4. Develop a common understanding of issues, problems, and plans with patients, their families, colleagues, and other professionals to develop shared care plans:
    - Effectively identify and explore problems that require attention, including the context of the patient's complaint and his/her responses, concerns, and preferences during medical imaging procedures;
    - Encourage questions, discussions, and interaction during medical-imaging procedures;
    - Include patients, their families, and relevant healthcare professionals in the decision-making process;
    - Effectively address challenging communication issues, such as obtaining informed consent and addressing anger, confusion, and misunderstandings.
5. Effectively convey oral and written information regarding medical-imaging procedures:
    - Maintain clear, accurate, and appropriate records (e.g., written or electronic) of medical imaging procedures;
    - Effectively present the findings of medical-imaging procedures in verbal or written reports;
    - Develop oral skills for individual consultations, case presentations, radiology conferences, and scholarly work.

3. Collaborator:

Definition:

As collaborators, RT&MI residents work within a healthcare team to provide optimal patient care.

Elements:

- Collaborative care, culture, and environment;
- Shared decision-making;
- Shared knowledge and information;
- Delegation;
- Effective teams;
- Respect for other RT&MI residents and members of healthcare teams;
- Leadership based on patient needs;
- Constructive negotiation;
- Organizational structures that facilitate collaborations;
- Understanding roles and responsibilities;
- Recognition of his or her roles and limits;
- Effective collaborations between primary care providers and specialists.

Key and Enabling Competencies:

RT&MI residents can:

1. Interact effectively and appropriately with other healthcare teams:
    - Clearly describe their roles and responsibilities to other professionals;
    - Describe the roles and responsibilities of other professionals within the imaging team;
    - Recognize and respect the diversity of roles, responsibilities, and competencies of other professionals in relation to their own;
    - Work with others to assess, plan, provide, and integrate care for individual patients (or groups of patients);
    - Work with others to assess, plan, provide, and review other tasks such as research problems, educational work, program reviews, or administrative responsibilities;
    - Effectively participate in meetings/settings of other teams;
    - Provide quality care;
    - Describe the principles of team dynamics;
    - Respect team ethics including confidentiality, resource allocation, and professionalism;
    - When appropriate, demonstrate leadership in imaging teams.
2. Work effectively with other health professionals to prevent, negotiate, and resolve conflicts:

- Demonstrate a respectful attitude toward other colleagues and members;
- Work with other professionals to prevent conflicts;
- Conduct collaborative negotiations to resolve conflicts;
- Respect differences, misunderstandings, and limitations regarding other professionals;
- Recognize his or her differences, misunderstandings, and limitations;
- Reflect on interprofessional team functions.

4. Manager:

Definition:

As managers, RT&MI residents engage with others to contribute to the vision of a high-quality RT&MI healthcare system, and take responsibility for delivering excellent patient care through their activities as clinicians, administrators, scholars, and/or teachers.

Elements:

- RT&MI residents as active participants in the RT&MI healthcare system;
- Collaborative decision-making;
- Quality assurance and improvement;
- Organize, structure, and finance the RT&MI healthcare system;
- Manage changes;
- Leadership;
- Supervise others;
- Administration;
- Consideration of justice, efficiency, and effectiveness in the allocation of finite RT&MI healthcare resources for optimal patient care;
- Budgeting and finances;
- Priority setting;
- Practice management;
- Human resources for RT&MI health;
- Time management;
- Negotiations;
- Career development;
- Information technology for RT&MI healthcare;
- Effective meetings and committees.

Key and Enabling Competencies:

RT&MI residents can:

1. Participate in activities that contribute to the effectiveness of RT&MI healthcare organizations and systems:

- Work collaboratively with other people from different organizations;
- Participate in systematic quality process evaluations and improvements such as those involving patient safety initiatives

- Describe the structure and functions of the healthcare system regarding specialties, including the roles of RT&MI residents and technologists;
- Describe the principles of healthcare finances, including the remuneration of technologists, budgeting, and organizational funding.

2. Manage resident practice and careers effectively:

- Establish priorities and manage time to balance patient care, practice requirements, outside activities, and a personal life;
- Manage finances and human resources;
- Implement processes to ensure personal practice improvement;
- Employ information technology appropriately for patient care.

3. Allocate finite RT&MI healthcare resources appropriately:

- Recognize the importance of a just allocation of healthcare resources, balanced effectiveness, efficiency, and access to optimal patient care;
- Apply evidence and management processes to provide cost-appropriate care.

4. Appropriately serve in administration and leadership roles:

- Effectively chair or participate in committees and meetings;
- Lead or implement changes in the RT&MI healthcare system;
- Plan the relevant elements of RT&MI healthcare delivery (e.g., work schedules).

5. Health Advocate:

Definition:

As health advocates, RT&MI residents contribute their expertise to improve RT&MI health through their work within communities or patient populations. They work with those they serve to determine and understand needs, speak on behalf of others when required, and support the mobilization of resources for effective change.

Elements:

- Support for individual patients, populations, and communities;
- Role of RT&MI professionals in society;
- Responsible use of authority and influence;
- Mobilize resources according to demand;

- Adapt practice, management, and education to the needs of individual patients;
- Provide a safe environment for patients and staff members;
- Minimize risks for patients undergoing radiological studies;
- Apply as-low-as-reasonably achievable principles and the implications for RT&MI health policy
- Interactions with other CanMEDS professionals and competencies in advocacy.

Key and Enabling Competencies:

RT&MI residents can:

1. Respond to individual RT&MI healthcare needs and issues of a patient:
    - Identify the RT&MI healthcare needs of individual patients;
    - Identify opportunities for advocacy, RT&MI health promotion, and disease prevention for individuals to whom care is provided;
    - Incorporate disease prevention, health promotion, and surveillance of RT&MI health in interactions with individual patients.
2. Respond to RT&MI healthcare needs of the communities they serve:
    - Describe the practice to communities;
    - Identify opportunities for advocacy, RT&MI health promotion, and disease prevention in communities and respond appropriately;
    - Appreciate the possibility of competing interests between different communities and populations.
3. Promote the RT&MI health of individual patients, communities, and populations:
    - Describe approaches for the implementation of changes in determinants of RT&MI health in populations;
    - Describe how public policy affects the RT&MI health of the specified populations;
    - Identify points of influence in the RT&MI healthcare system and its structure;
    - Describe the ethical and professional issues inherent in RT&MI health advocacy;
    - Appreciate the possible conflicts between RT&MI health advocates and managers or gatekeepers when serving patients or communities.

- Realize the role of an RT&MI professional by collectively advocating RT&MI health and patient safety.

6. Scholar:

Definition:

As scholars, RT&MI residents are expected to demonstrate a lifelong commitment to excellent practice through continuous learning, evidence evaluation, teaching others, and scholarship contributions.

Elements:

- Engage in the continuous enhancement of professional activities through lifelong learning;
- Reflection on all aspects of RT&MI practice;
- Self-assessment;
- Identify gaps in RT&MI knowledge;
- Access information for RT&MI practice;
- Translate knowledge into professional competencies;
- Enhance professional competencies;
- Use various learning methods;
- Assess learners;
- Provide feedback;
- Mentoring;
- Maintain teacher–student ethics, carefully resolve power issues, and maintain confidentiality and appropriate boundaries.
- Conduct research and scientific inquiries;
- Cope with research ethics, disclosures, conflicts of interest, human subjects, and industryrelations.

Key and Enabling Competencies:

RT&MI residents can:

1. Maintain and enhance professional activities via lifelong learning:
    - Know the principles of competency maintenance;
    - Know the principles and strategies for implementing a personal RT&MI knowledge management system;
    - Recognize and reflect on learning issues in RT&MI practice;

- Conduct personal RT&MI practice audits;
- Pose appropriate learning questions;
- Integrate new RT&MI learning techniques into practice;
- Evaluate the impact of changes on RT&MI practice;
- Document the learning process.

2. Critically evaluate RT&MI information and its sources and apply it to practice decisions appropriately:
   - Describe the principles of critical appraisal;
   - Critically appraise retrieved evidence to address clinical questions;
   - Integrate critical-appraisal conclusions into clinical care.
3. Appropriately facilitate learning for patients, their families, students, residents, other health professionals, the public, and others:
   - Know the learning principles relevant to the RT&MI education program;
   - Collaboratively identify the learning needs and desired learning outcomes of others;
   - Select effective teaching strategies and content to collectively facilitate the learning process;
   - Give effective lectures and presentations;
   - Assess and reflect on teaching encounters;
   - Provide effective feedback;
   - Describe the principles of ethics with respect to teaching.
4. Contribute to the development, dissemination, and translation of new RT&MI knowledge and practices:
   - Describe the principles of research and scholarly inquiries;
   - Describe the principles of research ethics;
   - Pose scholarly questions;
   - Conduct systematic research for evidence;
   - Select and apply appropriate methods for addressing questions.

Professional

Definition:

As professionals, RT&MI residents are committed to the RT&MI health and well-being of individuals and society through ethical practices, professional-

led regulations, and high personal standards regarding their behavior.

Elements:

- Humanity;
- Integrity and honesty;
- Compassion and caring;
- Ethics and codes of behavior;
- Responsibilities to society;
- Responsibilities to the profession;
- Responsibilities to oneself;
- Commitment to excellent RT&MI practice and proficiency in the discipline;
- Commitment to the promotion of public goods in RT&MI healthcare;
- Accountability to professional regulatory bodies;
- Commitment to professional standards;
- Bioethical principles and theories;
- Self-awareness;
- Sustainable practice and RT&MI healthcare;
- Self-assessment;
- Disclosure of errors and adverse events.

Key and Enabling Competencies:

RT&MI residents can:

1. Demonstrate commitment to patients by applying best practice and adhering to high ethical standards;
    - Exhibit appropriate professional behavior by including honesty, integrity, commitment, compassion, respect, and humanity in RT&MI practice;
    - Demonstrate commitment to deliver the highest quality of care and maintain competence;
    - Recognize and respond appropriately to ethical issues encountered in RT&MI practice;
    - Manage conflicts of interest appropriately;
    - Recognize the principles and limits of patient confidentiality;
    - Maintain appropriate relationships with patients.
2. Demonstrate commitment to society by recognizing and responding to societal expectations regarding RT&MI healthcare:
    - Demonstrate commitment to patients, society, and the profession by responding to societal expectations regarding RT&MI;
    - Demonstrate commitment to patient safety and quality improvement.
3. Demonstrate commitment to RT&MI health and sustainable practice:

- Balance personal and professional priorities to ensure personal health and a sustainable practice;
- Strive to heighten personal and professional awareness and insight;
- Recognize professionals in need and respond appropriately.

TEACHING AND LEARNING ACTIVITIES

The RT&MI residents will gain the competencies described in the curriculum through various learning methods. The program comprises training to acquire cognitive and technical skills and understand how they relate to physics, applied anatomy, pathology, and the physiology of health and disease. Moreover, training involves practical procedures and interpretation methods taught sequentially and integrated through lectures, tutorials, seminars, and apprenticeships that provide hands-on experience.

1. Formal Teaching and Learning Activities:
    - *Core specialty topics (70%),*
    - *Universal topics (10%),*
    - *Topics selected by RT&MI residents (20%).*
2. Practice-Based Learning:
    - *Journal club,*
    - *Discussion (logbook),*
    - *Guest speakers on core specialty topics,*
    - *Weekly academic half-day,*
    - *Tutorials.*
3. Work-Based Learning:
    - *On-call-based learning,*
    - *Clinic-based learning,*
    - *Courses and workshops*.
4. Self-Directed Learning

1) Formal Teaching and Learning Activities:

Core specialty topics (70%)

General skills needed for all specialties:

- Patient positioning;
- Awareness of sterile concept;

- Radiation protection;
- Understanding of quality control, radiology information systems, and PACS
- Human anatomy and physiology;
- Patient safety and care;
- Radiological pathology;
- Basic life support;
- Basic knowledge of medical physics (X-ray, CT, MRI, NM, and US).

GENERAL X-RAY SECTION

Training Rotation

The training rotation content will be very comprehensive, as RT&MI residents will be exposed to all areas of general X-ray imaging in the first part of the program (R1).

Objective:

Provide RT&MI residents with the capability to perform X-ray scans.

Acquired Skills:

- Perform imaging-related noninterventional procedures;
- Perform postprocessing procedures and image analysis;
- Practice skills related to basic imaging informatics;
- Produce high-quality diagnostic radiographs without supervision at the end of the rotation;
- Improve image quality and respond appropriately to critique.

Rotation Duration:

- Six months minimum;
- It can be extended if the RT&MI resident does not meet the minimum requirements after the initial period.

Training Rotation Plan:

Six months of rotation (see competency list for clinical rotations regarding general X-ray in APPENDIX 5):

- Enter patient data;
- Explain the procedure before the examination;
- Correlate patient to requisition;
- Stock and leave rooms clean and tidy;
- Practice proper infection control techniques;
- Basic understanding of universal precautions and isolation techniques;
- Knowledge of the location of all portable units inward and surgical areas;

- Practice proper radiation protection techniques for the patient and hospital staff;
- Able to prepare patients for examinations;
- Capable of obtaining an allergic history from patients;
- Understand how to enter patient exam information into computers;
- Read requisitions and perform required tests;
- Understand the effects of adjusting exposure factors on film;
- Complete most examinations under direct supervision;
- General knowledge of contrast materials used in the department;
- Load and unload C-arm cassettes;
- Perform portable chest X-rays onwards and intensive care units under direct supervision;
- Demonstrate proficiency while correlating patient requisitions;
- Know locations and have a basic understanding of emergency drugs;
- Knowledge of medical terminology;
- Complete most examinations under indirect supervision, including fluoroscopic procedures and portables, while using proper radiation protection;
- Aware of the safe use of and care for equipment;
- Correctly identify projection/views and anatomical parts on general radiographs;
- Examine images with the ability to correctly adjust exposure factors;
- Complete the following exams with indirect supervision (in accordance with the clinical rotation competency checklist provided for all exams, adults, and pediatric patients):

CHEST & THORAX

Chest routine

Chest anteroposterior

(wheelchair/stretcher)Chest

lateral decubitus

Ribs

Sternum

Upper airway (soft-tissue neck)

UPPER EXTREMITY

Thumb or finger

Hand

Wrist

Scaphoid

Forearm

Elbow

Humerus

Shoulder

Trauma: shoulder (scapular Y or axillary view)

Clavicle

Scapula

AC joints

Trauma: upper extremity (non-shoulder)

LOWER EXTREMITY

Femur

Knee

Trauma: knee

Patella

Tibia–fibula

Ankle

Foot

Forefoot

Toe

Calcaneus

ABDOMEN

Abdomen supine (KUB)

Abdomen upright

Abdomen decubitus

PELVIS

Pelvis Hip

Hip (cross-table lateral)

Sacroiliac joint

SPINE

Cervical spine

Trauma: cervical spine (cross-table lateral)

Oblique cervical spine

Cervical spine flexion/extension

Thoracic spine

Scoliosis spine

Lumbar spine

Sacrum and/or coccyx

HEAD

Skull

Paranasal sinuses

Facial bones

Orbits

Nasal bones

Mandible

PEDIATRICS (age six or younger)

Chest routine

Upper extremity

Lower extremity

Abdomen Pelvis

Mobile study

SURGICAL C-ARM PROCEDURES

Orthopedic C-arm procedures

Non-orthopedic C-arm procedures

GENERAL PATIENT CARE

Transfer of patients

Care for medical equipment of patients (oxygen tank and intravenous (IV) tubing)

INTERVENTIONAL RADIOLOGY AND FLUOROSCOPY

Training Rotation

The training rotation content will be very comprehensive as the RT&MI resident will be exposed to interventional radiology in a hands-on environment. In the first year (R1), the rotation segments cover the entire spectrum of interventional radiological examinations.

Objective:

Provide RT&MI residents with the capability to perform all procedures requested during angiography and fluoroscopy.

Acquired Skills:

- Perform imaging-related angiography and fluoroscopy procedures;
- Basic understanding of indications, techniques, and risks of fluoroscopy.

Program Duration:

- Six months minimum (four months of fluoroscopy; two months of angiography);
- It can be extended if the RT&MI resident does not meet the minimum requirements after the initial period.

Training Rotation Plan:

Six months of rotations (see competency list for clinical rotations regarding angiography and fluoroscopy in APPENDIX 6):

- Knowledge of department policies (e.g., working hours, uniform policy, sign-in and sign-out regulations);
- Operate the angiography unit;
- Aware of different types of catheters and guide wires and different applications of both;
- Correlate patient to requisition;

- Prepare major parts of a procedure tray;
- Knowledge of pre- and post-procedure care;
- Recognize the differences between guidewires and their applications;
- Proper handling of sterilized supplies;
- Prepare and select catheters or special sets for different procedures;
- Coordinate with nurses and physicians in different areas of the hospital for procedures;
- Provide proper post-examination care and instructions to patients and nursing staff when necessary;
- Work in special procedure areas and perform the entire range of examinations/procedures without supervision;
- Demonstrate the ability to complete the following exams under indirect supervision (in accordance with the clinical rotation competency checklist provided for all exams, adults, and pediatric patients):

FLUOROSCOPY PROCEDURES

Upper-gastric imaging

Small bowel series/follow-through

Air contrast examination of colon

Arthrography

QUALITY CONTROL OF

Basic radiographic equipment

Shielding devices

ADDITIONAL TASKS

Prepare contrast media

Format/optimize images

Ensure radiation safety

Maintain sterile/isolation precautions

Insert enema tip

GENERAL PATIENT CARE

Transfer of patients

Care for medical equipment of patients (oxygen tank and IV tubing)

MAGNETIC RESONANCE IMAGING (MRI)

Training Program

Objective:

- Provide RT&MI residents with the capability to master all MRI scans.

Acquired Skills:

- Understand and master the physics and principles of magnetic resonance (MR);
- Perform imaging-related MRI procedures;
- Understand indications, techniques, and risks of MRI.

Program Duration:

- Three months in the first part of the program (second year, R2);
- Two years for subspecialty in the second part of the program (third and fourth years, R3 and R4, respectively).

Training Rotation Plan

Three months for the first rotation (R2) (see competency list for clinical rotations regarding MRI in APPENDIX 7):

- Orientation of the department;
- Orientation of the physics of MRI;
- Orientation of magnets including coils;
- Orientation of basic departmental policies and procedures;
- Training in MR safety;
- The training in patient care skills includes:
    - Communication with patients and explanation of examinations;
    - MR screening sheets and questionnaires;
    - Practice of proper patient transfer techniques to ensure proper body mechanics.
- Interpretation of requests and correlation to patients;
- Observe and assist scanning technologists;

- Cross-sectional anatomy of the brain, neck, and spinal cord;
- Basic MR physics;
- Correct positioning of the coils for routine examinations;
- Beginning routine scanning under direct supervision (routine scans of the brain, cervical spine, thoracic spine, lumbar spine, and knees);
- Complete the following exams under indirect supervision (in accordance with the clinical rotation competency checklist provided for all exams, adults, and pediatric patients):

BODY PROCEDURES (ABDOMEN & PELVIS)

Routine liver scan Routine MRCP scan

NEURO & ENT PROCEDURES

Routine brain scan (infants, children, and adults)

Orbits/paranasal sinuses

Routine (cervical, thoracic, and lumbar) spine scan

PEDIATRIC MUSCULOSKELETAL PROCEDURES

Knee meniscus/trauma

Routine shoulder scan

Routine ankle scan

Routine foot scan

Routine elbow scan

Routine wrist/hand scan

MUSCULOSKELETAL PROCEDURES

Routine wrist/hand scan

Routine shoulder scan

Routine elbow scan

Routine knee scan

Routine ankle scan

Routine foot scan

NUCLEAR MEDICINE (NM)/POSITRON EMISSION TOMOGRAPHY (PET) IMAGING

Training Program

Objectives:

Provide RT&MI residents with the capability to master all NM scans.

Acquired Skills:

- Knowledge of Saudi Arabian regularity frameworks related to the practice of radionuclide radiology;
- Knowledge of NCCN guidelines for the regulation of PET/CT practice indications;
- Understand and master NM physics and principles.

Program Duration:

- Three months in the first part of the program (second year, R2);
- Two years for subspecialty in the second part of the program (third and fourth years, R3 and R4), respectively.

Training Rotation Plan:

Three months in the first rotation (R2) (see competency list for clinical rotations regarding NM in APPENDIX 8):

- Management of radiation accidents related to radionuclide radiology;
- Recognize different pharmaceuticals;
- Radiation dose from radiopharmaceuticals;
- General NM physics and principles;
- Principles of quality assurance in radiopharmacy;
- Role of comparative imaging tests;
- Radiation protection issues regarding tracer choice.
- Role of PET/CT in the staging of malignancies;
- Complete the following exams under indirect supervision (in accordance with the clinical rotation competency checklist provided for all exams, adults, and pediatric patients):

BONE SCAN

Metastasis

Osteomyelitis

Stress fracture/shin splint

Prosthesis evaluation (osteomyelitis versus loosing)

Avascular necrosis of bones

RENAL SCAN

Obstruction/function (MAG 3)

Transplanted kidney (MAG 3)

Dimercapto succinic acid (DMSA)

DMSA scan of pyelonephritis

DMSA scan of absolute split renal function

Testicular imaging with flow

ENDOCRINE IMAGING

MIBI scan of parathyroid adenoma

Thyroid uptake scan (I-123)

Thyroid nodule evaluation (I-123)

WBS of thyroid carcinoma (I-123)

Thyroid scan with ^{99m}TcO4

Adrenal imaging of the cortex/medulla

COMPUTER TOMOGRAPHY (CT)

Training Program

Objective:

Provide RT&MI residents with the capability to master all CT scans.

Acquired Skills:

- Understand and master CT physics and principles;
- Perform imaging-related CT procedures;
- Knowledge of indications, techniques, and risks of CTs.

Program Duration:

- Three months in the first part of the program (second year, R2).
- Two years for subspecialties in the second part of the program (third and fourth years, R3 and R4, respectively).

Training Rotation Plan

Three months in the first rotation (R2) (see competency list for clinical rotations regarding CT in APPENDIX 9):

- Knowledge of patient preparation for CT examinations;
- Safely move the patient from the chair and trolley to the CT table;
- Explain the examination to the patient;
- Ensure the safety of the patient and attached equipment (e.g., IV line, oxygen, and monitors);
- Knowledge of contrast media used in the department and recording contrast reactions;
- Knowledge of contrast media (IV and oral) volumes to be used for different CT examinations (adult and pediatric patients);
- Operate IV contrast injectors;
- Knowledge of proper infection control techniques;
- Knowledge of radiation protection for patients and staff;
- Positioning the patients properly for different studies;

- Operate machines independently and perform daily warm-ups and calibrations;
- Perform all requested CT examinations as ordered by the attending physician or supervisor;
- Deal with CT machine faults and report them to the biomedical engineer;
- Coordinate with other staff members to ensure appropriate patient care is provided;
- Knowledge of basic cross-sectional abdomen, chest, head, and neck anatomy;
- Complete the following exams under indirect supervision (in accordance with the clinical rotation competency checklist provided for all exams, adults, and pediatric patients):

ABDOMEN PROCEDURES

Anatomy CAP protocol

Abdomen pelvis protocol

NEURO & ENT PROCEDURES

Anatomy

Brain (adult) exam Brain (pediatric) exam Sinuses

Head and neck Cervical spine Thoracic spine Lumbar spine

THORAX

Anatomy

Routine chest scan without IV contrast media Routine chest scan with IV contrast media

Two years for the second rotation (R3 & R4) (see competency list for clinical rotations regarding CT in APPENDIX 10)

- Organize and execute the daily patient schedule;
- Perform all CT scan examinations with related 2D and 3D reformations;
- Increasing awareness regarding patient preparation and patient care;
- Knowledge of major pathologies and relating them to the appropriate protocols;
- Work efficiently and cope with emergency situations;
- Proficient case discussions with nurses, patients, physicians, and radiologists;
- Function as full team member during working shifts or on-call;
- Complete the following exams under indirect supervision (in accordance with the clinical rotation competency checklist provided for all exams, adults, and pediatric patients):

ABDOMEN PROCEDURES

Anatomy CAP protocol

Abdomen–pelvis protocol Dynamic liver protocol Dynamic renal protocol Trauma protocol

GI bleeding protocol Adrenal-mass protocol Pancreatic-mass protocol Renal-stones protocol Renal-mass protocol Bowel ischemia protocol Appendicitis protocol

IV line

NEURO & ENT PROCEDURES

Anatomy

Brain (adult) exam

Brain (pediatric) exam Parotid gland

Orbits Sinuses

Temporal bones Temporomandibular joints

Skull and facial bone Mandible

Head neck Neck Dental scan

Cervical spine Thoracic spine Lumbar spine

THORAX

Anatomy

Routine chest scan without IV contrast medium

Routine chest scan with IV contrast medium high-resolution chest scan

Pediatric scan Protocol selection Protocol adjustment Dose monitoring GA cases

Limb measurement Developmental dysplasia of the hip protocol

CAP AP

Chest IV line

CT ANGIOGRAPHY

Anatomy

Thoracic angiogram Abdominal angiogram Liver donor Colonography Pulmonary embolus Renal donor

Brain and neck angiogram Brain perfusion Stereotactic exam

3D process

MSK and developmental dysplasia of the hip procedure

PEDIATRIC EXAM

Biopsy, FNA, and RF ablation procedures Coronary artery angiogram

Pediatric coronary artery angiogram TAVI protocol

Fontan protocol caBIG protocol

Congenital cardiac protocol Dynamic trachea protocol Thoracic aortogram

Liver segmentation

Upper- and lower-extremity angiogram Dual-energy technique

GSI technique

ULTRASOUND (US)

Training Program

Objective:

Provide RT&MI residents with the ability to master all US scans.

Acquired Skills:

- Basic understanding of US artifacts;
- Understand and master US physics and principles;
- Perform imaging-related US procedures;
- Knowledge of indications, techniques, and risks of US.

Program Duration:

- Three months for the first part of the program (second year, R2).

Training Rotation Plan

Three months for the first rotation (R2) (see competency list for the clinical rotations regarding US in APPENDIX 11):

- Explain the procedure to the patient;
- Knowledge of basic scanning techniques for the abdomen;
- Optimize imaging resolution and document images;
- Deal with patients on beds and emergency cases;
- Prioritize different US requests;
- Correlate clinical data with scanning techniques;
- Interpret US findings;
- Recognize and document normal and abnormal findings;
- Write a report on scan findings;

- Analyze clinical data of patients;
- Complete the following exams under indirect supervision (in accordance with the clinical rotation competency checklist provided for all exams, adults, and pediatric patients):

ABDOMEN PROCEDURES

Upper GI tract Liver/biliary tract

Pancreas/spleen Renal/urinary system

SMALL-PARTS PROCEDURES

Abdominal wall

Thyroid

Universal Topics (10%)

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

The included topics 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 during hospital practice.

Development and Delivery:

The core topic content of the postgraduate curriculum will be developed and delivered centrally by the commission through an e-learning platform. A set of preliminary learning outcomes will be developed for each topic. In collaboration with the central team, content experts can modify the learning outcomes.

These topics will be didactic, focusing on the practical aspects of patient care. These topics will comprise more content than workshops and other interactive face-to-face sessions.

The suggested duration of each topic is 90 min.

The topic content will be delivered in a modular manner. At the end of each learning unit, a formative online assessment will be conducted. Furthermore, a combined summative assessment in the form of context-rich multiple-choice questions (MCQ) will be done after the completion of all topics. All trainees must attain at least a specified minimum level during the summative assessment. Alternatively, topics can be worked off in a summative manner along with the specialty examination.

1) Hospital-Acquired Infections (HAI):

At the end of the learning unit, the RT&MI resident should be able to:

a) Discuss the epidemiology of HAIs with special reference to Arabia;

b) Recognize HAIs as one of the major emerging threats in healthcare;

c) Identify the common sources HAIs;

d) Describe the risk factors for common HAIs, such as ventilator-associated pneumonia, MRSA, central Line-associated bloodstream infection, and vancomycin-resistant enterococcus;

e) Identify the role of healthcare workers in the prevention of HAIs;

f) Determine appropriate pharmacological (e.g., selected antibiotics) and nonpharmacological (e.g., removal of indwelling catheters) measures for the treatment of HAIs.

g) Propose a plan to prevent HAIs in workplaces.

2) Abnormal ECG:

At the end of this learning unit, the RT&MI resident should be able to:

a) Recognize common and important ECG abnormalities;

b) Institute immediate management, if necessary.

3) Care of the Older Adults:

At the end of this learning unit, the RT&MI resident should be able to:

a) Describe the factors that need to be considered when planning patient care for older adults

b) Recognize and include the needs and well-being of caregivers;

c) Identify the local and community resources available for the care of the older adults;

d) Develop an individualized care plan for older patients by including ideas from other healthcare professionals.

4) Occupational Hazards of Healthcare Workers (HCWs):

At the end of this learning unit, the RT&MI resident should be able to:

a) Recognize common sources and risk factors of occupational hazards among HCWs;

b) Describe common occupational hazards in workplaces;

c) Develop familiarity with legal and regulatory frameworks governing occupational hazards for HCWs;

d) Develop a proactive attitude to promote workplace safety;

e) Protect yourself and colleagues against potential occupational hazards in workplaces.

5) Patient Advocacy:

At the end of this learning unit, the RT&MI resident should be able to:

a) Define patient advocacy;

b) Recognize patient advocacy as a core value governing medical practice;

c) Describe the role of patient advocates in patient care;

d) Develop a positive attitude toward patient advocacy;

e) Be a patient advocate in conflicting situations;

f) Be familiar with local and national patient advocacy groups.

6) Ethical Issues: Treatment Refusal and Patient Autonomy:

At the end of this learning unit, the RT&MI resident should be able to:

a) Predict situations in which a patient or family member is likely to decline a prescribed treatment;

b) Describe the concept of a rational adult in the context of patient autonomy and treatment refusal;

c) Analyze key ethical, moral, and regulatory dilemmas regarding treatment refusal;

d) Recognize the importance of patient autonomy in the decision-making process;

e) Counsel patients and families declining medical treatment in the best interests of patients.

By RT&MI Residents Selected Topics (20%)

1. RT&MI residents from each specialty can choose any topic that fits their needs;
2. All topics must be planned and cannot be random;
3. All topics need to be approved by the local education committee;
4. Institutions can also work with RT&MI residents to determine the topics.

2) Practice-Based Learning

The activities listed below prepare and encourage RT&MI residents to conduct RT&MI practices and health service research independently.

Practice-Based Learning	Objective	CanMEDS Competencies
Journal club	• Journal articles are preselected, and the activity is prepared and discussed by residents under supervision to: ◦ Promote continuing professional development; ◦ Stay up-to-date with recent literature; ◦ Learn and practice critical appraisal skills.	Radiology Technology & Medical Imaging expert Scholar Health Advocate
Tutorial	• Tutorials provide a foundation for a good quality of knowledge regarding radiological interpretations; • Discuss and review imaging appearances and approaches for the diagnosis of various radiological conditions; • Develop confidence in handling clinical discussions.	Manager Radiology Technology & Medical Imaging expert Professional Scholar
Discussion (cases logbook)	• List all problems identified in RT&MI examinations; • Develop a proper solution for each problem.; • Present a follow-up of the problem.	Manager Radiology Technology & Medical Imaging expert Professional Scholar

Practice-Based Learning	Objective	CanMEDS Competencies
Guest speaker Joint specialty meeting	• Increase medical-imaging and resident knowledge and skills, and improve patient care; • Understand and apply current practice guidelines in medical imaging; • Describe the latest advances in the field of medical imaging and research; • Identify and explain areas of argument in the field of medical imaging.	Radiology Technology & Medical Imaging expert Professional
Academic half-day	• Provide the knowledge, technical skills, and experience necessary for residents to interpret and correlate clinical findings; • Promote effective communication and sharing of expertise with peers and colleagues; • Promote the development of investigative and technical skill processes for individual patients and patient populations; • Advice colleagues from his or her and other specialties with regard to problems related to medical imaging.	Radiology Technology & Medical Imaging expert Scholar Health Advocate Professional

WORK-BASED LEARNING

Work-Based learning	Objectives	CanMEDs
On-call-based learning	• Perform the basic procedures necessary forimaging and management; • Appropriately perform the required radiologicalexaminations; • Recognize imaging techniques and initialfindings; • Perform basic postprocessing proceduresand image analyses.	Radiology Technology & Medical Imaging expert Scholar Health Advocate Professional
Clinic-based learning	• Obtain the history of patients and conductphysical examinations; • Present briefly the initial findings or notes toattending radiologists; • Discuss differential and management planswith colleagues; • Discuss the need for special procedures withattending radiologists; • Supervise resident notes and orders; interpret and discuss report results with attending radiologists.	Radiology Technology & Medical Imaging expert Communicator Health Advocate

Courses

Several courses will be organized for RT&MI residents to augment their training in variousimportant areas.

Radiological Physics Course

Goals:

- Gain professional competence in radiation and applied physics and their clinical applications in RT&MI;
- Knowledge of various fundamentals of imaging modalities and their concept variations;
- Knowledge of basic imaging-related mathematics and calculations as well as dosimetry applications;
- Clearly understand radiation principles to properly deal with radiation hazards and implement radiation protection measures according to international guidelines and recommendations;
- Differentiate between modality-specific imaging chains and associated technology;
- Recognize technical parameters that can affect image quality and radiation dose;
- Knowledge of principles and practice of digital-image processing techniques;
- Recognize modality-specific image artifacts;
- Be up-to-date on the impact of emerging technologies on current practices;
- Knowledge of salient aspects of radiobiology and safe practice of radiation protection principles.

Training Methods:

- Annual four-week course in imaging-related physics that must be attended by all RT&MI residents; the required curriculum is listed below in the course content list;
- Discussion with radiology staff during case readouts and tutorial sessions on applied physical principles that influence image quality and patient and staff safety;
- Training centers can optionally provide additional lectures or activities to their residents.

Evaluation:

- The attendance rate for the four-week physics course will be incorporated into the annual overall performance evaluation score;
- Incorporation of radiological knowledge, skills, and safety aspects in rotation evaluations;
- Annual promotion exams.

Course Content

Radiation Physics—PART ONE (R1)

- Diagnostic Radiology
    - Conventional and digital X-ray imaging
    - Introduction to X-ray production
    - Particulate radiation
    - Interactions of particulate radiation with matter
    - Characteristic X-rays
    - Brems radiation

- X-Ray Generators
  - Transformers and production of high voltages
  - Control of tube voltage, tube current, and exposure time
  - Conventional single- and three-phase X-ray generators
  - High-frequency X-ray generators
- X-Ray Tubes and Source Assemblies
  - Modern diagnostic X-ray tubes
  - Line focus principle
  - Heel effect
  - Heat units and rating charts
- X-Ray Beam: Radiation Quantities and Units
  - Beam intensity and exposure
  - Absorbed dose and kerma
  - Exposure, energy fluence, photon fluence, and absorbed dose
  - Measurement techniques and ionization chamber
- X-Ray Beam: Geometrical Properties
  - Principles of shadow formation
  - Inverse-square law
  - Magnification and distortion collimator design and off-focus radiation
- X-Ray Beam: X-Ray Spectrum
  - X-ray spectrum
  - Duane–Hunt law
- Effects of kV, mA, and filtration
  - Intensity of characteristic and Brems radiation
- Interaction of X-Rays with Matter: Concepts
  - Photon attenuation
  - Scattering
  - Absorption
- Interaction of X-Rays with Matter: The Patient
  - Incident and transmitted X-ray spectra
  - Effects of kVp on Compton scattering and absorption
- Effects of kVp, mA, and Filtration on Transmitted Spectra
  - Absorption of edges and contrast media
- X-Ray Image: Basics

    - Subject contrast
    - Effects of scattering on subject contrast
- Scatter Control
- X-Ray Image: Digital Radiographic Systems
    - Basics
    - Digitizers (digitizing an analog film image)
- Computed Radiography
    - Digital flat-panel systems
- X-Ray Image: Conventional Fluoroscopy
    - Conventional-fluoroscopy systems
    - X-ray image intensifier
- Lens System
    - Video camera
    - Video monitor
- Automatic Brightness Control
- Automatic Gain Control
- Digital Fluoroscopy
- Digital Fluorography
- Digital Subtraction Angiography
- Angiography with Fluoroscopic Digital-Image Processing
- X-Ray Image Quality: Digital-Image Quality
    - Digital image fundamentals and pixel size
    - Pixel size in digital fluoroscopy
- Digital-Image Quality
    - Digital subtraction angiography and noise
    - Noise sources in digital X-ray imaging
- Equipment Design Considerations
- X-Ray Tube and Geometry
- Grid
- Automatic exposure control
- Screen/Film Processing Considerations

Radiation Physics—PART ONE (R2)

Computed Tomography (CT)

- CT Image Formation
- CT Scan Configuration
- Source Detector Configuration
- Multi-Row Detector versus Single-Row Detector
- Axial Scanning versus Helical Scanning
- Detectors
- X-Ray Tube
- CT Image Quality
  - Noise
  - Low-contrast detectability
  - High-contrast resolution
  - Field of View
- CT Scan Artifacts

Ultrasound Physics

- Characteristics of Sound Waves
- Interactions of US with Matter
- Introduction to Image Acquisition
- U/S Components
- Transducers
- Image Properties and Qualities
- Spatial Resolution (axial, lateral, and elevational)
- Image Formation (e.g., transmission power, gain, time gain compensation, frame rate)
- Discussion of Artifacts (all types of US artifacts) and Diagnosis

Magnetic Resonance Imaging (MRI)

- Introduction and Principles of MRI
- Image Weighting
- Parameters
- Pulse Sequences

- Artifacts
- MRI Safety

Nuclear Medicine Physics (NM)

- Principles of NM Physics
- Radioactive Decay
- Atomic and Nuclear Structures
- Interaction of Radiation with Matter
- Production of Radioisotopes
- Principles of Mo-99/Tc-99m Generators
- Components of Gamma Cameras

Radiation Biology

- Linear Energy Transfer and Relative Biologic Effectiveness
- Direct and Indirect Effects of Radiation
- Types of Radiation Effects
- Types of Radiation Exposure
- Radiation Protection Quantities and Units
- Justification
- Optimization
- Dose/Risk Optimization
- Protection of Pregnant Workers/Patients

Radiation Physics—PART TWO (R3 & R4)

- Radiation
- Definition
- Forms
    - Electromagnetics
        - Wave model
        - Photon model
            - Frequency
            - Wavelength
            - Energy
            - Spectrum
    - Particulate Radiation

        - Mass—energy equivalence
- Atom
- Structure
    - Orbit cloud
        - Composition
- Nonionized Atom
    - Ionized atom
    - Excited atom
- Electron-Binding Energy and Energy Levels
    - Electron transitions
- Characteristic X-ray
- Auger electron
- Nucleus
    - Composition
    - Nuclear force and energy levels
    - Classification of nuclides
    - Nuclear stability
    - Radioactivity
        - Decay (transformation)
            - ❖ Alpha decay
            - ❖ Beta-minus decay
            - ❖ Beta-plus decay
            - ❖ Electron capture
            - ❖ Isomeric transition
        - Decay scheme
        - Decay law
        - Half-life
    - Gamma rays
    - Internal-conversion electrons
- Nuclear Binding Energy and Mass Defect
- Nuclear Fission and Fusion
- Interactions of Radiation with Matter
    - Energy transfer
    - Scattering

- Interactions of particulate radiation
  - Electron interaction
  - Positron annihilation
  - Neutron interaction
  - Alpha
  - Proton
- Interactions of X-rays and gamma rays (photons)
  - Coherent or Rayleigh scattering
  - Compton scattering
  - Photoelectric effect
  - Pair production

Radiation Biology

- Teaching Content
- Human Response to Ionizing Radiation: Sequence of Events
- Linear Energy Transfer and Relative Biologic Effectiveness
- Direct and Indirect Effects of Radiation
- Formation of Free Radicals
- Effects on Cells: DNA and Chromosomes
- Cell Sensitivities
- Sensitivities in Different Cycles
- Factors Affecting Cell Sensitivity: Dose Rate, Fractionation, Chemicals
- Modifiers (Oxygen Effect and Radioprotectors)
- Cell Survival, Repair, and Death
- Sources of Information on Biological Effects
- Types of Radiation Effects
- Deterministic Effects
- Skin Effects
- Effects on Eye Lens
- Doses for Different Deterministic Effects
- Acute Radiation Syndromes
- Stochastic Effects
- Cancer Induction
- Hereditary Effects

- Early and Late Effects of Radiation
- Lethal Dose of LD 50/30
- Risk Estimation
- Sources of Radiation Exposure
- Natural Sources
- Artificial Sources
- Medical Sources
- Types of Radiation Exposure
  - External exposure
  - Internal exposure
- Categories of Radiation Exposure
  - Occupational exposure
  - Public exposure
  - Medical exposure
- Radiation Protection Bodies; Historical Events in Radiation Protection
- Radiation Protection Quantities and Units
  - Equivalent dose
  - Effective dose
  - Committed dose
  - Collective dose
- System of Radiological Protection
- Justification
- Optimization
- Dose/Risk Optimization
- Annual Limit of Intake
- Protection of Pregnant Workers/Patients
- Protection of Apprentices
- Categories of Work Areas
- Cardinal Principles of Radiation Protection
- Radiation Protection in Diagnostic X-Ray Imaging
- Sources of Exposure in Diagnostic X-Ray Procedures: Staff, Patients, and the Public
- Conventional Radiography
- Fluoroscopy and Interventional Radiology

- CT
- Mammography
- Radiation Protection in NM
- Sources of Exposure in NM: Staff, Patients, and the Public
- Receipt of Radioactive Materials
- Safe Handling and Administration of Radiopharmaceuticals
- Storage and Transfer of Radioactive Materials
- Radioactive Waste Management
- Surveys and Decontamination
- Handling Radiation Incidents
- Handling of Radioactive Patients

- Local and International Rules
- Protection of Lactating Mothers
- Protection of Pregnant Patients
- Radiation Protection in Radiotherapy
- Sources of Exposure for Staff and Public
- Protection of Patients, Staff, and the Public
- Interlock Checks
- Radiation Emergencies
- Shielding
- Factors to Consider in Shielding
- Primary and Secondary Shielding
- Testing of Shielding Thickness
- Shielding Requirements in Diagnostic X-Ray, NM, and Radiation Therapy
- Rationale for New ICRP Recommendations
    - Objectives
    - Phases
- Types of Exposure Regarding New Recommendations
    - Planned exposures
    - Existing exposures
    - Emergency exposures
- New Dose Limits
    - Pregnancy
    - Eye dose
- Dose Constraints and Reference Levels
- Radiation Weighting Factors
- Protection of Environment
- New IAEA Basic Safety Standards
- Rationale
- Phases of Development
- Dose Limits and Standards
- Specific Requirements
- Objectives for Patient Dosimetry

- Patient Dose Calculations in X-Ray Procedures
- Output Measurement: Method and Use in Patient Dose Calculation
- TLD Dosimetry: Method, Calibration, and Advantages
- Film Dosimetry: Method, Calibration, and Advantages
- EDR Films
- Radiochromic Films
- Patient Skin Dosimeter: Use and Testing
- Patient Dosimetry in CT
- Effective Dose Calculation
- Patient Dose Calculation in NM
- Diagnostic Procedures
- Therapeutic Procedures
- Fetal Dose

Computed Tomography (CT)

- CT versus Radiography
- CT Image Formation
- CT Scan Configuration
- Source Detector Configuration
- Multi-Row Detector versus Single-Row Detector
- Axial Scanning versus Helical Scanning
- Detectors
- X-Ray Tube
- Tissue Characterization
    - CT number (in Hounsfield units)
    - Definition of tissue contrast in CT images
- CT Image Quality
    - Noise
    - Low-contrast detectability
    - High-contrast resolution
    - Field of View
- CT Dosimetry
    - CT dose index (CTDI)
        - ❖ CTDI100

        - ❖ CTDIw
        - ❖ CTDIvol
        - ❖ Dose-length product
    - CT Dose
    - Overdose and Causes
    - Dose Management
        - Methods
        - Technology
    - CT Scan Artifacts

Examples of useful reading material

- The Essential Physics of Medical Imaging, 3rd Edition, by Jerrold T. Bushberg et al.
- Review of Radiologic Physics, 4th Edition, by Walter Huda.
- ICRP Publication 103, Good Reference for International Radiation Protection Standards, 1stEdition, by ICRP.

OTHER COURSES

Residents are required to present “Certificates of Completion” for the following courses from an accredited training center:

- Basic Life Support: during the years of training;
- Infection Control: during the years of training.

Residents are advised to coordinate with their program director to fulfill these courses.

Quality Improvement (QI)

General Objective:

RT&MI residents receive training in the basic principles of QI. The training is implemented in a dedicated course and/or comprehensive rotation.

Goals:

- Familiarization with QI terminology as well as available tools and methodology for improving the quality of technical and clinical performance in a radiology department (for instance, key performance indicators and the plan–do–study–act cycle);
- Familiarization with the workflow of a radiology department and other departments (surgery, medicine, and emergency medicine) and quality assurance (QA) systems; participation in QI activities of hospitals;
- Understand and apply audit procedures, including problem identification, action planning, and reassessment;
- Familiarization with tools for quality management of radiology services;
- Understand how performance improvements relate to patient safety in radiology;
- Complete a mentored research project and present the results at departmental QI rounds;
- Participate in departmental and hospital QI activities by attending committee meetings;
- Participate in hospital QA committee and departmental morbidity and mortality meetings;

- Knowledge of current research topics on quality in radiology; initiate and complete a project and participate in ongoing departmental QA audits;
- Acquire the necessary skills for scientific presentations and public discussions;
- Recognize opportunities for improvement regarding the radiology department functions.

The elective part includes online learning sessions, with a list of independent study materialsprovided to each RT&MI resident. Examples are provided below.

http://www.ihi.org/ www.patientsafety.va.govwww.RMF.org, www.jointcommission.org, www.apiweb.org.

Specific Objectives:

Patient safety

- Improve the accuracy of patient identification;
- Improve the effectiveness of communication among caregivers and ensure that they report critical test results and diagnostic procedures on a timely basis;
- Improve the safety of medication use and ensure that all medications, medication containers, and other solutions are labeled on and off the sterile field in perioperative and other procedural settings;
- Minimize the risk of healthcare-associated infections;
- Safe procedures and patient safety QI project topics that are particularly relevant toradiology include the following:
    - safe use of iodinated contrast materials,
    - radiation safety.

The appropriate completion of these courses will be considered in the overall annual evaluation scores.

Workshop

The RT&MI residents are encouraged to attend at least two workshops per year. These workshops will be conducted locally and internationally during the training program, and should be related to the CT field. Approval from the program director is required. The major tracks of the symposium and workshop can constitute but are not limited to:

- Appropriateness criteria for radiology: awareness, utilization, implementation, and impact;
- Diagnostic reference levels in MI: protocol optimization and patient dose reduction;
- MRI: basics and safety;
- Quality control in CT scanners: ACR testing;
- Quality control of SPECT systems;
- Radiotherapy treatment planning;
- Radiation safety officer course;
- 3D printing in radiation medicine.

Self-Directed Learning

Item	Objectives	CanMEDs
Self-Directed Learning	• Maintenance of personal portfolio (self-assessment, reflective learning, and personal development plan); • Achieving personal learning goals beyond the essential and core curriculum; • Reading (includes web-based material); • Auditing and conducting research projects; • Attending national and international conferences.	Professional Radiology Technology & Medical Imaging expert Scholar

SUGGESTED REFERENCE BOOKS:

General books

- Getting Started in Clinical Radiology: From Image to Diagnosis, Paperback, 2005, by George W. Eastman. Thieme.
- Radiologic Science for Technologists: Physics, Biology, and Protection, Hardcover, 11th edition, by Stewart C. Bushong. Mosby.
- Radiography: Technology, Environment, Professionalism. Paperback, 1998, by Frances E. Campeau. Lippincott Williams & Wilkins.
- The Practice of Radiology Education: Challenges and Trends. Hardcover, 2009, by Teresa van Deven. Springer-Verlag Berlin Heidelberg.
- The Essential Physics of Medical Imaging, Hardcover, 3rd Edition, by Jerrold T. Bushberg. Lippincott Williams & Wilkins.
- Patient Care in Radiography: With an Introduction to Medical Imaging, Paperback, 9th Edition, by Ruth A. Ehrlich. Mosby.

CT books

- Computed Tomography for Technologists: A Comprehensive Text, 2018, by Lois E. Romans. Lippincott Williams & Wilkins.
- Computed Tomography: Physical Principles, Clinical Applications, and Quality Control. Paperback, 3rd Edition, by Euclid Seeram. Saunders.
- Computed Tomography, Paperback, 1st edition, by Stewart C. Bushong. McGraw-Hill Education.
- Computed Tomography for Technologists: Exam Review. Paperback, 1st edition, by Lois E. Romans. Lippincott Williams & Wilkins.
- CT & MRI Pathology: A Pocket Atlas. Paperback, 1st edition, by Michael L. Grey and Jagan
- M. Ailinani. McGraw-Hill Education.

X-ray books

- Bontrager's Handbook of Radiographic Positioning and Techniques. Spiral-bound, 8th edition, by Kenneth L. Bontrager. Mosby.
- Clark's Positioning in Radiography. Hardcover, 13th edition, by Stewart Whitley. CRC Press.
- Radiographic Pathology for Technologists. Paperback, 6th edition, by Nina Kowalczyk. Mosby.

MRI books

- Handbook of MRI Technique. Paperback, 4th edition, by Catherine Westbrook. Wiley-Blackwell.
- MRI in Practice, Paperback, 5th edition, by Catherine Westbrook. Wiley-Blackwell.
- Handbook of MRI Scanning. Spiral-bound, 1st edition, by Geraldine Burghart Mosby.
- MRI Parameters and Positioning, Paperback, 2nd edition, by Torsten B. Möller. TPS.
- CT & MRI Pathology: A Pocket Atlas. Paperback, 1st edition. by Michael L. Grey. McGraw-Hill.

US books

- Ultrasound Scanning: Principles and Protocols. 4th edition, by Betty Bates Tempkin. Saunders.
- Workbook for Textbook of Diagnostic Sonography paperback, 8th edition, by Sandra L. Hagen–Ansert. Mosby.
- Sonography: Introduction to Normal Structure and Function. Paperback, 4th edition, by Betty Tempkin and Reva Arnez Curry. Saunders.

NM books

- Nuclear Medicine and PET/CT: Technology and Techniques. Hardcover, 7th edition, by Paul
- E. Christian. Mosby.
- Nuclear Medicine Physics: The Basic. Paperback, 7th edition, by Ramesh Chandra. Lippincott Williams & Wilkins.
- Fundamentals of Nuclear Pharmacy. Hardcover, 7th edition, by Gopal B. Saha. Springer.
- PET/MRI: Methodology and Clinical Applications. Paperback, 1st edition, by Ignasi Carrio, and Pablo R. Ros. Springer.

Radiology learning websites

https://radiopaedia.org/ https://www.radiologymasterclass.co.uk/
http://www.radiologyassistant.nl/

ASSESSMENT

1. Purpose of Assessment

Assessments play a vital role in the success of postgraduate training. The assessment guides trainees and trainers in achieving the targeted learning objectives. In addition, reliable and valid assessments will provide an excellent means for training improvement, as they will inform the following aspects: curriculum development, teaching methods, and the quality of the learning environment. This assessment serves the following purposes:

a. **Assessment for learning**: Trainers will use information from trainees' performances to inform their learning to improve.

b. **Assessment as learning**: **Assessment** criteria will drive trainees' learning.

c. **Assessment of learning**: **Assessment** outcomes will represent quality metrics that can improve the learning experience.

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

Formative and Summative.

2. Formative Assessment

2.1 General Principles

As adult learners, trainees should strive for feedback from "novice" to "mastery" levels throughout their journey of competency. *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. The input from the overall formative assessment tools will be utilized at the end of the year to promote each trainee from the current to the next training level. A formative assessment will be defined based on the scientific committee recommendations (usually updated and announced at the start of the academic year). According to the executive policy on continuous assessment (available online at www.scfhs.org), formative assessment will include the following features:

a. Multisource: minimum four tools.

b. Comprehensive: covering all learning domains (knowledge, skills, and attitude).

c. Relevant: focusing on workplace-based observations.

d. Competency-milestone oriented: reflecting the trainee's expected competencies that match the trainee's developmental level.

Trainees actively seek feedback during training. Furthermore, trainersare expected to provide timely and formative assessments. The SCFHS will provide an e-portfolio system to enhance communication and analysis of data arising from formative assessments.

2.2 Formative Assessment Tools

Residents' performance will be jointly evaluated by the respective staff members by applying the following:

A. In-training evaluation reports (ITER)

The CanMEDS-based competencies "In-training Evaluation Report (ITER)" form (APPENDIX 2) must be completed (preferably in electronic format), with signatures of at least two senior technologists, within two weeks after the end of each rotation. If necessary, the program director discusses the evaluations with the RT&MI residents, if necessary. The evaluation form is submitted to the SCFHS training supervisory committee within four weeks of the conclusion of the rotation. The ITERs should be conducted at least three times, covering nine training months per year.

B. Workplace Assessment:

- Performance of RT&MI resident during daily work;
- Performance in a direct observational assessment of 10–20 min regarding trainee–patient interactions;
- Direct observation of procedural skills: Diagnostic and therapeutic procedural skills. Timely and specific feedback from trainers to RT&MI residents is mandatory after each procedure.

C. The end-of-year examination will be limited to R1, R2, and R3 residents. The number of examinations, eligibility, and passing scores were established in accordance with the ommission's training and examination rules and regulations. The examination details are published on the commission's website www.scfhs.org.sa.

- The format shall include 100–150 MCQ, in which thefour best options must be chosen (or A-type).
- The examination shall contain K1 and K2 cognitive-level questions (recall and comprehension), usually delivered as questions with scenarios (interpretation, analysis, decision making, reasoning, and problem solving) in accordance with a test blueprint.
- The examination shall include questions from medical sciences, including anatomy, physiology, pathology, and physics
- Summary table of the formative assessment tools:

Gen.	Level	Knowledge					Skills							Professional Behavior (Attitude)
		SOE	EYPT-In't	Academic Activities	CbD	EYPT-Local	OSCE/OSPE	Research	DOPS	Logbook	Volunteering	mini - CEX	Other	Evaluation - ITERS
Radiology Technology & Medical Imaging	R1	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓
	R2	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	R3	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	R4			✓	✓			✓	✓	✓	✓	✓		✓

Tools' Abbreviations:

- **R1:** Residency year one
- **R2:** Residency year two
- **R3:** Residency year three
- **R4:** Residency year four
- **SOE:** Structured Oral Exam
- **CbD:** Case-based Discussion
- **EYPT-Local:** End of year progress test (local)
- **EYPT-In't:** End of year progress test (International)
- **DOPS:** Direct Observation of Procedural Skills
- **Mini-CEX:** mini -Clinical Evaluation Exercise
- **ITER:** In-training Evaluation Report

Description table of formative assessment tools:

CT Radiology Technology			
	Assessment & Teaching Requirements	Requirements	Definitions & Descriptions
Knowledge	**Academic Activities***	**R1–R4:** Trainees are required to attend 40 academic half-day lectures during the Academic Activity sessions.	Trainees are required to attend all the lectures in the weekly half-academic days (and any excused absence must be approved by the program director). The academic half-day duration must be a minimum of 2 hours. Lectures should cover all topics mentioned in all rotations (Appendix 5, 6, 7, 8, 9, 10, and 11). Trainees' attendance must be logged and comply with SCFHS rules and regulations. (see "Evaluation of the presenter by staff supervisor" in APPENDIX 3)

CT Radiology Technology			
	Assessment & Teaching Requirements	Requirements	Definitions & Descriptions
	Educational Activities	**R1–R4 During Academic-Half Day**: • Trainees are required to do at least one presentation/academic year from the topic presentations. • Trainees are required to review and present at least two journal Clubs/academic year. • Trainees are required to do at least one case study from their rotations.	
	SOE	**R1–R3:** Trainees are required to take the SOE.	SOE is used to assess the trainee's knowledge and as a practice/mock exam similar to the final SOE to better prepare the trainees for it.
	EYPT-Intl' (progress test)	N/A	NA
	EYPT-Local (progress test)	**R1–R3:** Trainees are required to take a written progress test according to SCFHS regulations.	Trainees are required to take the End-of-Year Progress Test, which is composed of a minimum of 100 MCQs based on the exam blueprint.
	CbD	**R1–R4:** Trainees are required to do a minimum of six CBD/ Academic Year. Results on forms are for formative feedback purposes.	CBD is a Workplace-based Assessment (WPBA) tool used to assess the trainee's clinical decision-making and reasoning skills for their patients' management. It helps to understand the logic behind the decisions made in the clinical setting and how trainees compile, prioritize and apply their knowledge. The form is initiated from the trainee's side on Asessements system (or PDF if the asysment system has not been activated yet), and they send it to their preceptors. The form is then filled in by the preceptor during the discussion with the trainee (it is a

CT Radiology Technology			
	Assessment & Teaching Requirements	Requirements	Definitions & Descriptions
			one-on-one discussion). It usually takes 15 minutes and 5–10 minutes of feedback.
Skills	**OSCE/OSPE**	**R1–R3:** Trainees are required to take the OSCE/OSPE Results on forms are for formative feedback purposes.	This is used to assess the trainee's clinical/practical performance and application of knowledge skills and as a practice/mock exam similar to the final OSCE/OSPE to better prepare the trainees for it.
	Research	**Required Activities the trainee must complete:** **Regarding the E-Module (R2)** **R2:** Trainees are required to complete the SCFHS Research and the SCFHS Evidence-based Practice (EBP) e-module and provide proof of completion to the program director. **Regarding the Research Proposal (R3 & R4):** 1. Prepare the study design and methodology within the accepted research types are mentioned in the description section. 4. Complete its proposal and have it approved by the program director and training program committee (TPC). **R3:** Trainees are required to submit a research proposal with the IRB approval letter or TPC (Appendix 12) **R4:** Trainees are required to submit at least one abstract for	The research must be original work in radiology technology in their fields; the trainee conducts all research steps. Topics need to be approved by the program director according to SCFHS criteria, and the research proposal needs to be approved by the IRB or Training Program Committee (TPC). The following research types are **NOT** accepted: review articles, case reports, case series, meta-analyses, editorials, and basic science topics.

CT Radiology Technology			
	Assessment & Teaching Requirements	Requirements	Definitions & Descriptions
		poster OR oral presentation OR submit the research according to SCFHS criteria to graduate from the program. (Appendix 13)	
	DOPS	**R1–R4:** Trainees are required to perform at least six DOPS/academic year; cases can be from the logbook cases. Results on forms are for formative feedback purposes	This is a Workplace-based Assessment (WPBA) tool used to assess the trainee's procedural, practical and technical skills. The form is initiated from the trainee's side on assessments system, and they send it to their preceptors. The form is then filled in by the preceptor who supervised the trainee after discussing the performance with the trainee. It usually takes 15 minutes and 5–10 minutes of feedback.
	Logbook	**Logbook Cases (R1–R4):** 1. Trainees must achieve the required number of procedures according to the logbook table below according to the level. 2. The cases must meet the competencies checklist as per each rotation(Appendix 1) **On-call based learning (R3 & R4):** • R3 Trainees are required to complete a minimum of eight on-calls per year. • R4 Trainees are required to complete a minimum of 10 on-calls per year.	Logbooks are used for documentation of procedural activities. Shifts are defined as maximum of eight hours of activities included in the duty hours definition. On-calls are defined as at-home (i.e., out of the hospital) shift where the resident works independently, but with a senior on-call radiology technology of the same field, to answer clinical consultation calls from the hospital during hours outside of the resident's shift for the day.

CT Radiology Technology			
	Assessment & Teaching Requirements	Requirements	Definitions & Descriptions
		In case there is no on-call in the unit, this can be compensated by the same number of shifts as per level above.	
	Volunteering	R1–R4: Trainees are required to participate in volunteering-based activity of **at least 10** volunteer hours related to the field on the health volunteer platform. OR participate in activities such as awareness campaigns, presenting a lecture to the community, etc. **Must** provide a certificate or proof of participation.	
	Mini-CEX	**R1–R4**: Trainees must complete **at least** six Mini-CEX/academic year. The results are used for formative feedback purposes.	This is a Workplace-based Assessment (WPBA) tool used to assess the trainee's skills during the daily rounds regarding communication, patient counseling and medication reconciliation. The form is initiated from the trainee's side on assessment system, and they send it to their preceptors. The form is then filled in by the preceptor who supervised the trainee after discussing the performance with the trainee. It usually takes 15 minutes and 5–10 minutes of feedback.
Professional Behavior (Attitude)	**ITERS**	**R1–R4:** ITERs are used as end-rotation evaluation. ITERs must be completed fulfilling its requirements following SCFHS regulations.	It is the evaluation completed at the end of each rotation that assesses the trainee's performance in all competencies throughout the rotation using the SCFHS-approved ITER form set up assessment system .

CT Logbook:

Level	Modality	Case per day
R1	X-ray	10
	Fluoroscopy	2
	IR	2
R2	CT	5
	US	4
	MRI	3
	NM	2
R3	CT	7
R4	CT	7

The final scoring will align with the updated bylaws related to formative assessments and educational activities. Hence, some wording may have changed accordingly. Trainees are required to fulfill all the training and assessment requirements. Not complying with these will subject the trainee to disciplinary actions according to the SCHFS bylaws and regulations.

In summary, formative assessment aims to ensure that all residents fulfill the CanMEDS competency requirements at the end of each training rotation and for academic year evaluation. Academic and clinical assignments were documented annually using an electronic tracking system (e-logbook when applicable) (Appendix 1). Evaluations are based on accomplishing the minimum requirements of procedures and clinical skills as determined by the program.

3. Summative Assessment

3.1 General Principles

Summative assessment is the component of assessment that primarily aims to make informed decisions about trainees' competency. Unlike formative assessment, *summative assessment* does not aim to provide constructive feedback. For further details, please refer to the general bylaws and the executive policy of assessment (available online: www.scfhs.org). To be eligible to sit for final exams, a trainee should be granted a "*Training-Completion Certificate.*"

3.2 Principles of RT&MI Examination (Saudi Board Examination: Part I):

It is a written exam that permits the trainee to be promoted from "junior" to "senior" level of training.

This examination is conducted in written MCQ format and held at least once per year. The number of examinations, eligibility, and passing scores are established in accordance with the commission's training, examination rules, and regulations (available online at www.scfhs.org). Examination details and a blueprint are published on the commission's website.

3.3 Training-Completion Certificate

To be eligible to sit for the final specialty examinations, each trainee is required to obtain a "Training-Completion Certificate." Based on the training bylaws and executive policy (please refer to www.scfhs.org) trainees will be granted a "Training-Completion Certificate" once the following criteria are fulfilled:

a. Successful completion of all training rotations.

b. Final In-Training Evaluation Report (FITER)/Comprehensive Competency Report (APPENDIX 4): the program directors prepare a FITER for each RT&MI resident at the end of year R4. Clinical or oral

examinations or the completion of other academic assignments can be involved. Completion of training requirements as outlined by the scientific council/committee of each specialty (e.g., logbook, research, and others).

c. Clearance from SCFHS training affairs to ensure compliance with tuition payments and completion of universal topics.

The "Training-Completion Certificate" will be issued and approved by the local supervisory committee or its equivalent according to SCFHS policies.

3.4 Final RT&MI Board Examination (Saudi Board Examination: Part II):

The final specialty examination is the summative assessment component that grants trainees certification of the specialty. It has two elements:

A. Final written exam: to be eligible for this exam, trainees are required to have the "Training-Completion Certificate." This examination assesses the trainee's theoretical knowledge (including recent developments) and problem-solving abilities regarding their specialty. The examination was delivered in a multiple-choice format and held at least once a year. The number of exams, exam format, eligibility, and passing scores will be in accordance with the commission's training, examination rules, and regulations. More details on the examination and blueprints are published on the commission's website: www.scfhs.org.sa.

B. Clinical examination:

This examination assesses a broad range of high-level clinical skills, including data gathering, patient management, communication, and counseling. This examination is held at least once every year, preferably scanning a real patient at any chosen center, and the OSCE will be regarding patient management problems. Trainees were required to pass the final written exam to be eligible for the final clinical examination. Eligibility and passing scores are evaluated in accordance with the commission's training, examination rules, and regulations.

Examination details and a blueprint are published on the commission website, www.scfhs.org.sa.

Format:

Station number: 12–15 stations;

Stations: a mixture of skill stations and patient management format;

For further details on the final examinations, please refer to the general bylaws and executive policy ofthe assessment (available online at www.scfhs.org).

3.5 Certification:

The certificate for training completion will be awarded to RT&MI residents only upon successfully fulfilling all program requirements. Candidates must pass both written and clinical examinations independently (i.e., there is no compensation for unsatisfactory results). Candidates passing all components of the final specialty examination are awarded the “Saudi Board of Radiology Technology & Medical Imaging” certificate.

EXAM BLUEPRINTS

Part One Exam Blueprint Outlines:

No.	Sections	Percentage
1	Radiation protection	10%
2	X-ray physics and instruments	10%
3	Radiographic anatomy, pathology, and positioning	10%
4	Picture archiving and communication systems and quality control	5%
5	Fluoroscopy machine and procedure	8%
6	Angiography machine and procedure	8%
7	Ultrasound physics and instruments	7%
8	Ultrasound abdominal procedure and technique	6%
9	Nuclear medicine physics and instruments	6%
10	Nuclear medicine hot lab and pharmaceutical preparation	5%
11	Computer tomography physics and instruments	6%
12	Computer tomography brain anatomy, procedure, and technique	6%
13	Magnetic resonance imaging physics and instruments	7%
14	Magnetic resonance imaging brain anatomy, procedure, and technique	6%

No.	Sections	Percentage
	Total	100%

Promotion Exam Blueprint Outlines:

R1:

No.	Section	Percentage
1	General X-ray Physics	20%
2	X-ray Technique	20%
3	Fluoroscopy	15%
4	Angiogram	15%
5	Radiation Protection	15%
6	Image Quality	15%
Total		100%

R2:

No.	Section	Percentage
1	Computed Tomography Imaging (Physics & Instrumentation)	20%
2	Magnetic Resonance Imaging (Physics & Instrumentation)	20%
3	Ultrasound Imaging (Physics & Instrumentation)	20%
4	Molecular and Nuclear Imaging (Physics & Instrumentation)	20%
5	Neuro and Abdomen Techniques	10%
6	Radiology Informatics	10%
Total		100%

R3:

No.	Section	Percentage
1	Advanced Computed Tomography (CT) Imaging (Physics & Instrumentation)	30%
2	Advanced CT Techniques	20%
3	CT Image Quality	20%
4	Cross-sectional Anatomy & Pathology	20%
5	Post-processing	10%
Total		100%

Final Examination Blueprint Outlines:

No.	Sections	Percentage
1	Physics & Instrumentation	15%
2	Radiation Safety and protection	10%
3	Head & Neck	12%
4	Spine	10%
5	Vascular Imaging	10%
6	Body	15%
7	Musculoskeletal	10%
8	Advance Technique	6%
9	Image Artifact	6%
10	Postprocessing	6%
Total		100%

Final Clinical Blueprint Outlines:

No.	Sections
1	Physics & Instrumentation
2	Radiation Safety and protection
3	Head & Neck
4	Spine
5	Vascular Imaging
6	Body
7	Musculoskeletal
8	Advance Technique
9	Image Artifact
10	Postprocessing

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APPENDICES

APPENDIX 1/logbook

SCOPE OF THE LOGBOOK:

- Maintain records and document all academic activities (e.g., procedures, lectures, meetings, training courses, workshops, symposia, and presentations) undertaken during the training program;
- Assist the RT&MI resident in identifying his or her deficiencies in specific areas;
- Assist the program director/evaluator in documenting the contributions and evaluation ofRT&MI residents;
- Provide the evaluator with guidance regarding appropriate and fair assessment of RT&MIresidents;
- Provide the program director with guidance regarding deficiencies in training.

GUIDELINES FOR RT&MI RESIDENTS:

- RT&MI residents are required to maintain logbooks during the entire training period;
- Logbook entries concerning recorded activities should be completed on the day on whichthe activities occur;
- All entries must be signed by a mentor within one week after completion;
- RT&MI residents should discuss their training progress with theirmentor and/or program director every month, as indicated in the logbook.
- RT&MI residents should submit their completed logbooks to the program director at the endof their rotations and training sessions for subsequent submission to the regional supervisory committee.
- If the program director does not sign a logbook, the RT&MI resident is ineligible for end-of-training certification and final examinations.

Example of an RT&MI Logbook				
Comments			Activity	Date

APPENDIX 2

In-Training Evaluation Report (ITER) FORM

Not applicable	Exceeds expectations (4)	Clear Pass (3)	Borderline case (2)	Clear failure (1)	
					A. Radiology Technology & Medical Imaging (RT&MI)expert
					Clinical & Technical Knowledge
					1. Understands the technical and clinical sciences in RT&MI.
					2. Understands the clinical presentation and natural history of common pathologies observed via imaging.
					3. Demonstrates expertise in all technical and clinical aspects and management of common radiological procedures.
					4. Avoids unnecessary or harmful investigations or management.
					5. Provides care.
					6. Demonstrates appropriate knowledge, skills, and attitude.
					7. Formulates appropriate differential RT&MI techniques.
					8. Develops an appropriate plan of RT&MI investigations and interprets the results.
					Procedural skills

Not applicable	Exceeds expectations (4)	Clear Pass (3)	Borderline case (2)	Clear failure (1)	
					9. Understands the indications, contraindications, and complications of specific RT&MI procedures.
					10. Demonstrates mastery of specific RT&MI procedure techniques.
					B. Communicator
					11. Records appropriate progress notes.
					12. Communicates with medical staff in an appropriate manner.
					13. Communicates with patients in an appropriate manner.
					14. Communicates with patient families in an appropriate manner.
					15. Delivers understandable information to patients and their families.
					16. Maintains professional relationships with other healthcare providers.
					17. Provides clear and complete records, reports, and informed and written consent.
					C. Collaborator
					18. Works effectively in a team environment.

Not applicable	Exceeds expectations (4)	Clear Pass (3)	Borderline case (2)	Clear failure (1)	
					19. Can work with allied healthcare staff.
					20. Can work with nursing staff.
					21. Can work with attending and junior medical staff.
					22. Consults effectively with other physicians and healthcare providers.
					D. Manager
					23. Participates in activities that contribute to the effectiveness of healthcare organizations and systems.
					24. Manages his or her practice and career effectively.
					25. Allocates finite healthcare resources appropriately.
					26. Serves appropriately in administration and leadership roles.
					27. Uses information technology to optimize patient care, lifelong learning, and other activities.
					E. Health advocate
					30. Ensures that patients have access to appropriate support, information, and services.
					31. Offers advocacy on behalf of his or her patients and general population levels

Not applicable	Exceeds expectations (4)	Clear Pass (3)	Borderline case (2)	Clear failure (1)	
					F. Scholar
					32. Attends and contributes to rounds, seminars, and other learning events.
					33. Discusses and presents selected topics in an appropriate manner.
					34. Demonstrates adequate ability to conduct a literature search.
					35. Demonstrates efforts to increase knowledge.
					36. Accepts and acts on constructive feedback.
					37. Is informed about patient cases and takes an evidence-based approach to management problems.
					38. Contributes to the education of patients, house staff, students, and other health professionals.
					39. Contributes to the development of new knowledge.
					G. Professional
					40. Recognizes his or her limitations and seeks advice and consultation when necessary.
					41. Understands the professional, legal, and ethical obligations of physicians.
					42. Delivers evidence-based care with integrity, honesty, and compassion.

Not applicable	Exceeds expectations (4)	Clear Pass (3)	Borderline case (2)	Clear failure (1)	
					43. Demonstrates appropriate insight into his or her strengths and weaknesses.
					44. Shows initiative within the limits of his or her knowledge and training.
					45. Discharges duties and assignments responsibly and in a timely and ethical manner.
					46. Reports facts accurately, including his or her errors.
					47. Maintains appropriate boundaries in work and learning situations.
					48. Respects diversity in race, age, gender, disability, intelligence, and socioeconomic status.
Total score = _____ x 25 = 100% Number of evaluated items =				TOTAL SCORE	

Program Director:____

Comments:

_____

_____

_____

_____

_____

_____

I certify that I have read all the parts of this evaluation report and discussed it with theevaluators.

Resident name:_____ Signature:_____

Evaluator name:_____ Signature:_____

Evaluator name:_____ Signature:_____

Program Director:_____ Signature:_____

APPENDIX 3

RT&MI Resident Presentation Evaluation by Staff Supervisor

RT&MI Resident name:_____

Level:_____

Staff Supervisor:_____

Date of Presentation:_____

Topic:_____

Very Good (5)	Good (4)	Acceptable (3)	Weak (2)	Very Weak (1)	Radiology Technology & Medical Imaging expert
					Demonstrated thorough knowledge of the topic
					Presented at an appropriate level and with adequate details
					Comments (optional)
					Communicator
					Provided objectives and an outline
					Clear and organized presentation
					Used clear, concise, and legible materials

Very Good (5)	Good (4)	Acceptable (3)	Weak (2)	Very Weak (1)	Radiology Technology & Medical Imaging expert
					Used effective methods and presentation style
					Established good rapport with the audience
					Collaborator
					Included comments from learners and led discussions
					Worked effectively with staff supervisor in the session preparation
					Comments (optional)
					Health advocate
					Managed time effectively
					Addressed preventive aspects of care when relevant
					Comments (optional)

Very Good (5)	Good (4)	Acceptable (3)	Weak (2)	Very Weak (1)	Radiology Technology & Medical Imaging expert
					Scholar
					Posed appropriate learning questions
					Accessed and interpreted relevant literature
					Comments (optional)
					Professional
					Maintained patient confidentiality when clinical material was used
					Identified and managed relevant conflicts of interest
					Comments (optional)

APPENDIX 4

Final In-Training Evaluation Report (FITER)/Comprehensive Competency Report		
RT&MI Resident name:		
SCFHS number:		
NO	YES	**Evaluation covering the last year of the resident:** According to the committee of the fellowship program, the aforementioned trainee has acquired competencies in pediatric hematology/oncology as prescribed by the training objectives. The resident can practice as a specialist. (Please tick the appropriate box.)
The following information sources were used for the evaluation:		
NO	YES	Items
		Written exams
		Clinical rotations
		Feedback from healthcare professionals
		Completion of a scholarly project
		Other evaluations

Note: If, during the period between the date of the signature of this document and the completion of the training, the residency program committee judges that the demonstrated competencies of the candidate are inconsistent with the present evaluation, the residency program committee can declare the document null and void and replace it with an updated FITER. In that case, eligibility for the examination depends on the updated FITER.
Comments:
Name of Program Director:
Date: Signature:
I certify that I have read this document.
Name of Resident: SCFHS number: Date: Signature: Resident Comments:

APPENDIX 5

X-RAY Clinical Rotation Competency Checklist R1

NAME:_____
_____

TODAY'S DATE:
:_____

ACTIVE SCHS
#::_____

TYPES OF EXAMS PERFORMED: Please put "X" next to your level of skills and experience as X- Ray Technologist.

PROFICIENT RATINGS:
(1) No Clinical Experience,
(2) Observed and Assisted,
(3) Limited Experience,
(4) Competent,
(5) Very Proficient

CHEST & THORAX	No Clinical Proficient				
	1	2	3	4	5
Chest Routine					
Chest anteroposterior (Wheelchair / Stretcher)					
Chest Lateral Decubitus					
Ribs					
Sternum					
Upper Airway (Soft-Tissue Neck)					
UPPER EXTREMITY	**1**	**2**	**3**	**4**	**5**
Thumb or Finger					
Hand					
Wrist					
Scaphoid					
Forearm					
Elbow					
Humerus					
Shoulder					

CHEST & THORAX	No Clinical Proficient				
	1	2	3	4	5
Trauma: Shoulder (scapular Y, or Axillary) *					
Clavicle					
Scapula					
AC Joints					
Trauma: Upper ExtremityNon-shoulder					
LOWER EXTREMITY	**1**	**2**	**3**	**4**	**5**
Femur					
Knee					
Knee - Trauma					
Patella					
Tibia - Fibula					
Ankle					
Foot					
Fore Foot					
Toe					

CHEST & THORAX	No Clinical Proficient				
	1	2	3	4	5
Calcaneus					
ABDOMEN	**1**	**2**	**3**	**4**	**5**
Abdomen Supine (KUB)					
Abdomen Upright					
Abdomen Decubitus					

X – RAY Clinical Rotation
Competency Checklist R1

PELVIS	**1**	**2**	**3**	**4**	**5**
Pelvis					
Hip					
Hip (cross-table lateral)					
Hip Jaudette					
Sacroiliac Joints					
SPINE	**1**	**2**	**3**	**4**	**5**
Cervical Spine					
Cervical Spine Trauma (cross table lateral)					
Cervical Spine Oblique's					
Cervical Spine Flexion / Extension					
Thoracic Spine					
Scoliosis Series					
Lumbar Spine					
Sacrum and / or Coccyx					
HEAD	**1**	**2**	**3**	**4**	**5**
Skull					
Paranasal Sinuses					
Facial Bones					
Orbits					
Nasal Bones					
Mandible					
PEDIATRICS (age 6 or younger)	**1**	**2**	**3**	**4**	**5**
Chest Routine					
Upper Extremity					
Lower Extremity					
Abdomen					
Pelvis					
Mobile Study					
SURGICAL PROCEDURES C-ARM	**1**	**2**	**3**	**4**	**5**
C-Arm Procedure (Orthopedic)					
C-Arm Procedure (non- Orthopedic)					
GENERAL PATIENT CARE	**1**	**2**	**3**	**4**	**5**
Transfer of patient					
Care of patient medical equip (oxygen tank, IV tubing)					
				YES	**NO**
I have experience in the following equipment (please list).					
1. Picture Archiving & Communication System (PACS)					
2. SECTRA Radiology Information System (RIS)					
3. ICIS Hospital Information System (HIS)					

This information I have provided in this checklist is true and accurate to the best of my knowledge.

Signature/Date

APPENDIX 6

Fluoroscopy & Angiography Clinical Rotation Competency Checklist R1

NAME:_____

_____

TODAY'S DATE:

_____

ACTIVE SCHS #:

_____

TYPES OF EXAMS PERFORMED: Please put "X" next to your level of skills and experience as X- Ray Technologist.

PROFICIENT RATINGS:
(1) No Clinical Experience,
(2) Observed and Assisted,
(3) Limited Experience,
(4) Competent,
(5) Very Proficient

PROCEDURES	No Clinical Proficient				
	1	2	3	4	5
Upper gastric imaging					
Small bowel series/follow through					
Air contrast colon					
Arthrography					
QUALITY CONTROL OF:	**1**	**2**	**3**	**4**	**5**
Basic radiographic equipment					
Shielding devices					
ADDITIONAL TASKS	**1**	**2**	**3**	**4**	**5**
Prepare contrast media					
Format/Optimize images					
Ensure radiation safety					
Maintain sterile/isolation precautions					
Insert enema tip					
GENERAL PATIENT CARE	**1**	**2**	**3**	**4**	**5**
Transfer of patient					

PROCEDURES	No Clinical Proficient				
	1	2	3	4	5
Care of patient medical equipment (oxygen tank and IV tubing)					
				YES	NO
I have experience in the following equipment (please list).					
1.Picture Archiving & Communication System (PACS)					
2.SECTRA Radiology Information System (RIS)					
3.ICIS Hospital Information System (HIS)					

The information I have provided in this knowledge and skills checklist is true and accurate to the best of my knowledge.

_____

Signature/Date

_____

_____

Page 1 -

APPENDIX 7

Magnetic Resonance Imaging Clinical Rotation Competency Checklist R2

NAME:

_____

_

TODAY'S DATE:

_____

ACTIVE SCHS #:

_____

TYPES OF EXAMS PERFORMED: Please put "X" next to your level of skills and experience as an MRI Technologist.

PROFICIENT RATINGS:
(1) No Clinical Experience,
(2) Observed and Assisted,
(3) Limited Experience,
(4) Competent,
(5) Very Proficient

BODY PROCEDURES (ABDOMEN & PELVIS)	No Clinical Proficient				
	1	2	3	4	5
Routine Liver					
Routine Magnetic Resonance Cholangiopancreatography					
NEURO & ENT PROCEDURES	**1**	**2**	**3**	**4**	**5**
Routine Brain (Infants, Children and Adults)					
Orbits / Paranasal Sinuses					
Routine (Cervical, Thoracic and Lumbar) Spine					
PEDIATRIC MSK PROCEDURES	**1**	**2**	**3**	**4**	**5**
Knee Meniscus / Trauma					
Shoulder (Routine)					
Routine Ankle					
Routine Foot					
Routine Elbow					
Routine Wrist / Hand					
MSK PROCEDURES	**1**	**2**	**3**	**4**	**5**
Wrist / Hand (Routine)					
Shoulder (Routine)					

BODY PROCEDURES (ABDOMEN & PELVIS)	No Clinical Proficient				
	1	2	3	4	5
Routine Elbow					
Knee (Routine)					
Routine Ankle					
Routine Foot					
				YES	NO
I have experience in the following equipment (please list).					
1.Picture Archiving & Communication System (PACS)					
2.SECTRA Radiology Information System (RIS)					
3.ICIS Hospital Information System (HIS)					
4.					
5.					

The information provided in this knowledge and skills checklist is true and accurate, to the best of my knowledge.

_____

Signature/Date

_____

_____

Page 2

APPENDIX 8

Nuclear Medicine Clinical Rotation Competency Checklist R2

NAME:

_____

__

TODAY'S DATE:

_____

ACTIVE SCHS #:

_____

TYPES OF EXAMS PERFORMED: Please put "X" next to your level of skills and experience as an MRI Technologist.

PROFICIENT RATINGS:
(1) No Clinical Experience, (2) Observed and Assisted, (3) Limited Experience, (4) Competent, (5) Very Proficient

BONE SCAN	No Clinical Proficient				
	1	2	3	4	5
METASTASIS					
OSTEOMYELITIS					
STRESS FRACTURE/ SHIN SPLINT					
PROSTHESIS EVALUATION (OSTEOMYELITIS VS. LOOSING)					
AVASCULAR NECROSIS OF BONE					
RENAL SCAN	**1**	**2**	**3**	**4**	**5**
Obstruction / Function (MAG 3)					
Transplanted Kidney (MAG 3)					
Cortical Scar (DMSA)					
Pyelonephritis (DMSA)					
Absolute Split Renal Function (DMSA)					
Testicular Imaging with Flow					
ENDOCRINE IMAGING	**1**	**2**	**3**	**4**	**5**
Parathyroid Adenoma(MIBI)					
Thyroid Uptake Scan (I-123)					
Thyroid Nodule Evaluation (I-123)					
WBS For Thyroid Carcinoma(I-123)					

BONE SCAN	No Clinical Proficient				
	1	2	3	4	5
Thyroid Scan With 99m Tco4					
Adrenal Imagining Cortex/Medulla					
				YES	NO
I have experience in the following equipment (please list).					
1. Picture Archiving & Communication System (PACS)					
2. SECTRA Radiology Information System (RIS)					
3. ICIS Hospital Information System (HIS)					
4.					
5.					

The information Iprovided in this knowledge and skills checklist is true and accurate, to the best of my knowledge.

_____

Signature/Date

_____

_____

APPENDIX 9

Computed Tomography Clinical Rotation Competency Checklist R2

NAME:

_____

__

TODAY'S DATE:

_____

ACTIVE SCHS #:

_____

TYPES OF EXAMS PERFORMED: Please put "X" next to your level of skills and experience as an Ultrasound/Sonographer Technologist.

PROFICIENT RATINGS:
(1) No Clinical Experience,
(2) Observed and Assisted,
(3) Limited Experience,
(4) Competent,
(5) Very Proficient

	No Clinical				Proficient
	1	2	3	4	5
ABDOMINAL – PROCEDURE					
ANATOMY					
CAP PROTOCOL					
ABDO PELVIS PROTOCOL					
RENAL STONES PROTOCOL					
NEURO & ENT	**1**	**2**	**3**	**4**	**5**
ANATOMY					
BRAIN (adult) exam					
BRAIN (pediatric)					
SINUSES					
HEAD NECK					
C – SPINE					
T – SPINE					
L – SPINE					
THORACIC	**1**	**2**	**3**	**4**	**5**
ANATOMY					
ROUTINE CHEST WITHOUT IV CONTRAST					

	No Clinical				Proficient
	1	2	3	4	5
ROUTINE CHEST WITH IV CONTRAST					
I have experience in the following equipment (please list).				**YES**	**NO**
PACS (PICTURE ARCHIVING & COMMUNICATION SYSTEM					
SECTRA SYSTEM					
ICIS SYSTEM					

The information I have provided in this knowledge and skills checklist is true and accurate, to the best of my knowledge.

_____

Signature/Date

_____

_____

Page 4-

APPENDIX 10

Computed Tomography

Clinical Competency Checklist R3 & R4

NAME: TODAY'S DATE:

ACTIVE SCHS #:

TYPES OF EXAMS PERFORMED: Please put "X" next to your level of skills and experience as an Ultrasound/Sonographer Technologist.

PROFICIENT RATINGS:
(1) No Clinical Experience,
(2) Observed and Assisted,
(3) Limited Experience,
(4) Competent,
(5) Very Proficient

	No Clinical				Proficient
	1	2	3	4	5
ABDOMINAL – PROCEDURE					
ANATOMY					
CAP PROTOCOL					
ABDO PELVIS PROTOCOL					
LIVER – DYNAMIC PROTOCOL					
RENAL – DYNAMIC PROTOCOL					
TRAUMA PROTOCOL					
GI BLEEDING PROTOCOL					
ADRENALS MASS PROTOCOL					
PANCREATIC MASS PROTOCOL					
RENAL STONES PROTOCOL					
RENAL MASS PROTOCOL					
BOWEL ISCHEMIA PROTOCOL					
APPENDICITIS PROTOCOL					
IV LINE					
NEURO & ENT	1	2	3	4	5

	No Clinical				Proficient
	1	2	3	4	5
ANATOMY					
BRAIN (adult) exam					
BRAIN (pediatric)					
PAROTID					
ORBITS					
SINUSES					
TEMPORAL BONES					
T.M.J.					
SKULL & FACIAL BONE					
MANDIBLE					
HEAD NECK					
NECK					
DENTAL SCAN					
C - SPINE					
T - SPINE					
L - SPINE					
THORACIC	**1**	**2**	**3**	**4**	**5**

	No Clinical				Proficient
	1	2	3	4	5
ANATOMY					
ROUTINE CHEST WITHOUT IV CONTRAST					
ROUTINE CHEST WITH IV CONTRAST					

Computed Tomography Clinical Competency Checklist R3 & R4

HIGH RESOLUTION CHEST					
Pediatric	1	2	3	4	5
Select protocol					
Adjust protocol					
Monitoring the dose					
GA cases					
Limb measurement					
DDH PROTOCOL					
CAP					
AP					
CHEST					
IV LINE					
CT Angiography	1	2	3	4	5
ANATOMY					
THORACIC ANGIOGRAMS					
ABDOMINAL ANGIOS					

HIGH RESOLUTION CHEST					
LIVER DONAR					
COLONOGRAPHY					
PULMONARY EMBOLUS					
RENAL DONAR					
BRAIN, NECK ANGIOGRAM					
BRAIN PERFUSION					
STEREOTACTIC EXAM					
3 DIMENSION PROCESS					
MSK, DDH, PROCEDURE					
Pediatric exam					
BIOPSY, FNA, AND RF ABLATION PROCEDURE					
CORONARY ARTERY ANGIOGRAM EXAM					
CORONARY ARTERY ANGIOGRAM PEDIATRIC					
TAVI PROTOCOL					
FONTAN PROTOCOL					
CABIG PROTOCOL					

HIGH RESOLUTION CHEST					
CONGENITAL CARDIAC					
DYNAMIC TRACHEA PROTOCOL					
THORACIC AORTOGRAM					
Liver segmentation					
UPPER & LOWER EXTREMITY ANGIOGRAM					
DUAL ENERGY TECHNIQUE					
G.S.I TECHNIQUE					
I have experience in the following equipment (please list).				**YES**	**NO**
PACS (PICTURE ARCHIVING & COMMUNICATION SYSTEM					
SECTRASYSTEM					
ICISSYSTEM					

The information I have provided in this knowledge and skills checklist is true and accurate, to the best of my knowledge.

_____

Signature/Date

_____

_____

APPENDIX 11

Ultrasound / Sonographer Clinical Rotation Competency Checklist R2

RESIDENT'S NAME

_____

TODAY'S DATE:

_____

ACTIVE SCHS #:

_____

TYPES OF EXAMS PERFORMED: Please put "X" next to your level of skills and experience as an Ultrasound/Sonographer Technologist.

PROFICIENT RATINGS:
(1) No Clinical Experience,
(2) Observed and Assisted,
(3) Limited Experience,
(4) Competent,
(5) Very Proficient

	No Clinical			Proficient	
	1	2	3	4	5
ABDOMINAL – PROCEDURE					
APPENDIX/INTUSSUSCEPTION					
GI TRACT					
LIVER/BILIARY TRACT					
PANCREAS/SPLEEN					
RENAL/URINARY SYSTEM					
SMALL PARTS – PROCEDURE	**1**	**2**	**3**	**4**	**5**
ABDOMINAL WALL					
THYROID					
				YES	**NO**
I have experience in the following equipment (please list).					
1. Picture Archiving & Communication System (PACS)					

	No Clinical				Proficient
	1	2	3	4	5
2. SECTRA Radiology Information System (RIS)					
3. ICIS Hospital Information System (HIS)					
4.					
5.					

The information I have provided in this knowledge and skills checklist is true and accurate, to the best of my knowledge.

_____

Signature/Date

_____

_____

APPENDIX 12

Research Evaluation R3

NAME: **Hospital:**

Proposal		N/A	Below Expectations	Borderline	Meets Expectations	Above Expectation
Idea:						
1	Proposed Research idea					
2	Attractive title reflecting content of the research					
Introduction:						
3	Background					
4	Literature Review					
5	Rational					
6	Problem / Gap					
7	Research Question, Objective and Aims					
Methods:						
8	Study Design					
9	Study Settings					
10	Study Population					
11	Sample size / Sampling technique					
12	Data collection methods					
13	Analysis methods and programs					
14	Timeframes					
Conclusion:						
15	Conclusion					
16	References					
IRB:						
17	Submission to IRB					
18	IRB Approval					
Overall:						

APPENDIX 13

Research Evaluation R4

NAME: **Hospital:**

	Research	N/A	Below Expectations	Borderline	Meets Expectations	Above Expectation
Introduction:						
1	Background					
2	Literature Review					
3	Rational					
4	Problem / Gap					
5	Research Question, Objective and Aims					
Methods:						
6	Study Design					
7	Study Settings					
8	Study Population					
9	Sample size / Sampling technique					
10	Data collection methods					
11	Analysis methods and programs					
12	Timeframes					
IRB:						
13	Submission to IRB					
14	IRB Approval					
Manuscript:						
15	Attractive title reflecting content of the research					
16	Authors					
17	Abstract					
18	Discussion					
19	Results					
20	Conclusions					
21	References					
22	The candidate's role in the research					
Overall:						