Imaging Rotation

Resident: _______________________________________

Rotation staff mentor/ advisor: James Balter, supplemental mentors: Dale Litzenberg, Don Roberts, Joann Prisciandaro, Adam Johansson

Rotation Dates: ________________________________

A medical physics resident in radiation oncology at the University of Michigan will be expected to demonstrate the following competencies associated with imaging. These are considered the minimum standards. The resident should complete the list of assignments during his/her rotations.
Contents Outline

Knowledge Factors
- List of reading assignments
- Read and understand TG-58
- Read and understand TG-75
- Read and understand TG-104
- Read and understand TG-128
- Read and understand TG-147
- Read and understand TG-179

Practical Factors
- Perform CT daily, monthly and annual QA
- Perform MRI daily QA
- Perform CBCT QA
- Perform ultrasound measurement of prostate phantom
- Observe PET/SPECT imaging
- Perform Calypso calibration and demonstrate proficiency using system

Knowledge Factors – List of reference

Short list of useful references (this is by far not a comprehensive list):

- ACR MRI Phantom QA Procedure
- AAPM TG 132 draft
- AAPM Task Group #58 - Clinical use of electronic portal imaging
- AAPM Task Group #75 - The management of imaging dose during image-guided radiotherapy
- AAPM Task Group #104 - The Role of In-Room kV X-Ray Imaging for Patient Setup and Target Localization
- AAPM Task Group #179 - Quality assurance for image-guided radiation therapy utilizing CT-based technologies
- AAPM Task Group #147 - Quality assurance for non-radiographic radiotherapy localization and positioning systems
- AAPM MR Task Group #1 – Acceptance Testing and Quality Assurance Procedures for Magnetic Resonance Imaging Facilities
- AAPM Task Group #128 – Quality assurance tests for prostate brachytherapy ultrasound systems
- AAPM Task Group #142 – Quality assurance of medical accelerators (imaging sections)
- Introduction to the Science of Medical Imaging (Bryan)
- The Essential Physics of Medical Imaging (Bushberg et al.)
**Knowledge Factors – General Imaging**

Discuss and demonstrate an understanding of the general principles of image quality

Signature / Date

Discuss and demonstrate an understanding of contrast agents for medical imaging

Signature / Date

Discuss and demonstrate an understanding of image registration techniques (e.g., rigid and deformable registration), and image features on which registration can be based (e.g., landmarks, segments, intensities).

Signature / Date

Discuss and demonstrate an understanding of IT architecture for imaging

Signature / Date

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**Knowledge Factors – Radiography/Fluoroscopy**

Demonstrate an understanding of TG-58

Signature / Date

Demonstrate an understanding of TG-75

Signature / Date

Demonstrate an understanding of TG-104

Signature / Date

Discuss and demonstrate an understanding of detector technology for on-board MV and kV imaging, as well as measures of image quality.

Signature / Date

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**Knowledge Factors – CT/CBCT**

Demonstrate an understanding of TG-179

Signature / Date

Discuss and demonstrate an understanding of the basic principles of CT (slice thickness, pitch, kVp, mAs, contrast, 4D gating, difference between CT sim and diagnostic CT).

Signature / Date

Discuss and demonstrate an understanding of CT reconstruction methods

Signature / Date

Discuss and demonstrate an understanding of imaging protocols for CT

Signature / Date

Discuss and demonstrate an understanding of image artifacts in CT

Signature / Date

Discuss and demonstrate an understanding of dose minimization techniques in radiography

Signature / Date

Discuss and understand the major subsystems of a CT simulator.

Signature / Date

Discuss and demonstrate an understanding of CT-ED curve generation

Signature / Date

Discuss and demonstrate an understanding of CTDI.

Signature / Date

Discuss and demonstrate an understanding of CT number/Hounsfield units.

Signature / Date

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**Knowledge Factors – MRI**

Discuss and demonstrate an understanding of the basic principles of MRI

Signature / Date
Discuss and demonstrate an understanding of the uses of MRI in radiation oncology.

**Signature / Date**

Discuss and demonstrate an understanding of the advantages and disadvantages of treatment planning using MRI

**Signature / Date**

Discuss and demonstrate an understanding of MRI imaging protocols

**Signature / Date**

Discuss and demonstrate an understanding of the types and causes of distortion in MRI

**Signature / Date**

**Knowledge Factors – PET/SPECT**

Discuss and demonstrate an understanding of the basic principles of PET

**Signature / Date**

Discuss and demonstrate an understanding of the basic principles of SPECT

**Signature / Date**

Discuss and demonstrate an understanding of radioisotopes used for nuclear imaging

**Signature / Date**

Discuss and demonstrate an understanding of the uses of nuclear imaging in radiation oncology

**Signature / Date**

Discuss and demonstrate an understanding of QA for PET-CT and SPECT-CT simulators

**Signature / Date**

**Knowledge Factors – Ultrasound**

Discuss and demonstrate an understanding of TG-128

**Signature / Date**

Discuss and demonstrate an understanding of the basic principles of ultrasound imaging

**Signature / Date**

Discuss and demonstrate an understanding of the uses of ultrasound in radiation oncology

**Signature / Date**

Discuss and demonstrate an understanding of methods of QA for ultrasound probes

**Signature / Date**

**Knowledge Factors – Other non-radiographic systems**

Discuss commonly used non-radiographic localization systems (e.g., radiofrequency beacon tracking, surface camera).

**Signature / Date**

Discuss and demonstrate an understanding of the basic principles of radiofrequency beacon tracking.

**Signature / Date**

Discuss and demonstrate an understanding of the basic principles of surface camera tracking.

**Signature / Date**

**Knowledge Factors – Deformable Image Registration**

Demonstrate understanding of fundamental elements of deformable alignment and their uncertainties/evaluation methods

**Signature / Date**

**Practical Factors – in-room radiographic imaging**

Perform daily, monthly, and annual QA for OBI

**Signature / Date**

Perform daily, monthly, and annual QA for MV EPID

**Signature / Date**
Practical Factors – CT/CBCT

Perform an acceptable subset of daily, monthly, and/or annual QA for the CT scanner
Signature / Date

Demonstrate and obtain competency for CBCT alignment.
Signature / Date

Practical Factors – MRI

Perform weekly QA for the MRI scanner
Signature / Date

Observe MRI simulation for brain
Signature / Date
Signature / Date

Observe MRI simulation for abdomen
Signature / Date
Signature / Date

Practical Factors – Ultrasound

Perform ultrasound measurement of prostate phantom
Signature / Date

Practical Factors – PET/SPECT/Nuclear Medicine

Observe PET OR SPECT procedure
Signature / Date

Observe Radiopharmaceutical production
Signature / Date

Practical Factors – Deformable Image Registration

Observe/perform deformable alignment (H/N or liver)
Signature / Date