University of Mississippi Medical Center (UMMC)
Department of Radiation Oncology
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Clinical rotations

Rotation cycle #1

This first cycle is designed to introduce the resident to the clinical duties for each rotation. In the first six-month rotation through the clinical assignments, the resident observes the clinical medical physicist performing the duties of that rotation. During this time they are expected to learn all clinical medical physics responsibilities for each rotation and document all clinical procedures. The resident has a limited hands-on role during the first cycle of rotations. All duties will be approved by the supervising clinical medical physicist.

Rotation cycle #2

For each rotation, the staff medical physicist shall briefly review the contents covered in the first rotation cycle. The staff medical physicist will address insufficient knowledge in any area. The resident will perform all clinical duties under the supervision of the staff medical physicist. The resident is expected to independently perform all duties while using the staff medical physicist as a reference resource when necessary. Independent performance of clinical duties is expected for adequate performance at completion of this cycle of rotations.

Rotation cycles #3 and #4

The resident will be credentialed at UMMC prior to the beginning of Clinical Rotation #3. For cycles #3 and #4 (i.e., residency year #2) the resident is expected to cover a clinical FTE medical physicist workload. The resident is expected to independently perform all applicable clinical duties. A staff medical physicist will not be assigned to the resident in these rotation cycles. However, clinical medical physics faculty will be available as necessary to address any resident issues to ensure completion of assigned resident duties.

Monthly Rotation Assignments

Month 1 and 2: UMMC Initial Checks/Insert Factors/Chart Closeouts

Initial Plan Checks:

The staff physicist shall explain and demonstrate procedures for initial checks of patient treatment plans. This includes performance of the plan check, approval of all fields in R&V system, and completion of any documentation required for billing or patient records. All documentation is to be signed by the staff physicist on the rotation. The rationale for performing initial plan checks shall be explained. Checks will include verification of the following information in the treatment plan and MOSAIQ:

- Prescription and fractionation

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- Correct patient CT data set
- Correct CT-to-density table selection
- Correct CT matrix size
- Couch removal
- External contour density threshold
- Dose matrix voxel dimensions
- Density overrides
- Treatment unit (for each beam)
- Field name (for each beam)
- Modality (for each beam)
- Delivery type (for each beam)
- Monitor units (for each beam)
- Beam modifiers or applicators (for each beam)
- Number of beam segments if applicable (for each beam)
- Dose (for each beam)
- Secondary jaw settings (for each beam)
- Field shape (for each beam)
- Tolerance table (for each beam)
- SSD (for each beam)
- Couch angle (for each beam)
- Collimator angle (for each beam)
- Gantry angle (for each beam)
- Dose calculation algorithm (for each beam)
- Evaluation of doses to target volumes and normal tissues
- Performance of BED calculations when necessary

The resident shall independently review all plans assigned to the clinical physicist. For rotation documentation, the resident shall select 10 sample plans with 2 from each of the following anatomic sites:

- Lung
- Brain
- Prostate
- Breast
- Head and neck

Resident documentation

The resident shall check these plans under the review of the staff physicist. Once the staff physicist has verified the resident's competency for the 10 plans, the resident will print copies of the plan .pdf files, remove any protected health

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information (PHI), and compile a binder for resident rotation documentation and review by the staff physicist and Program Director.

Secondary MU checks:
The staff physicist will explain and demonstrate the performance of secondary MU calculations to verify the MU's determined by the planning system. This includes performance of the calculation and completion of any documentation required for billing or patient records. The staff physicist shall review manual calculation of MU's (SSD and SAD calculations) using data from the UMMC clinical physics data book. The staff physicist shall explain differences in dose calculation methods between the planning system and secondary MU check program, including examples of when there are expected differences between the two. The resident shall independently perform secondary MU checks for all plans assigned to the clinical physicist.

Resident documentation
For rotation documentation, the resident shall print the secondary MU check documentation for the 10 treatment plans previously described after removing any PHI, and add the documentation to the rotation binder for resident documentation, which will be reviewed by the staff physicist and Program Director.

Electron MU calculations:
The staff physicist will explain and demonstrate procedures for determination of electron insert factors by measurement and the use of these factors in MU calculations. The staff physicist shall demonstrate and explain the completion of all documentation required in the performance of these tasks.

Resident documentation
The resident will retain copies of electron MU calculation forms performed on the rotation in the rotation binder.

Linac and CT QA:
The staff physicist shall explain and demonstrate the monthly QA procedures for the Elekta Synergy (SN 1130), Elekta Synergy (SN 1828), Elekta Synergy S (SN 1250) linear accelerators and Phillips Brilliance 16-Slice Big Bore CT Simulator (SN 7329). This includes both mechanical and dosimetric tests where applicable. The staff physicist shall demonstrate preparation of all appropriate documentation and placement of documentation in appropriate data books.

Resident documentation

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Documentation of monthly QA performance shall be maintained in the resident's rotation binder.

Chart closeouts:
The rationale for performing chart closeouts shall be explained. The staff medical physicist shall explain and demonstrate procedures for chart closeouts of patients who have completed or discontinued treatment. Chart closeouts shall include verification of the following information:

- Total delivered dose
- Completion of all appropriate documentation
- Signatures and approval for all documentation
- Verification and completion of all appropriate billing charges

The resident shall independently perform chart closeouts for all patients assigned to the staff medical physicist.

Resident documentation
The resident shall select 10 patients for evaluation by the staff medical physicist. The resident will perform chart closeouts for these 10 patients under the supervision of the staff medical physicist. Once the medical physicist has verified competency, the performance of these closeouts will be documented in the resident's rotation binder.

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Month 3: UMMC LDR (Low Dose Rate) Brachytherapy

The staff physicist shall explain and demonstrate the performance of pre- and post-plan checks for all LDR procedures occurring during the rotation. These procedures include all LDR prostate implants (available only at MBPCC) and COMS Eye Plaque procedures. Duties include performance of the plan check and completion of any documentation required for billing or patient records.

The staff physicist shall explain and demonstrate the performance of assays for all received LDR brachytherapy sources. This includes the preparation of all appropriate documentation and placement of all documentation in the appropriate binders. The staff physicist shall explain and demonstrate the performance of the LDR physics duties. The resident shall accompany the staff physicist to all LDR cases that occur during the rotation assignment.

Resident documentation

The resident shall independently review all LDR (pre- and post-plans) assigned to the staff physicist. For rotation documentation, the resident shall select 5 sample plans for documentation. The resident shall check these plans under the review of the staff physicist. Once the staff physicist has verified the resident's competency for the 5 plans, the resident will print copies of the plan .pdf files, remove any protected health information (PHI), and compile a binder for resident rotation documentation and review by the staff physicist and Program Director.

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Month 4: UMMC Clinic/IMRT

The staff physicist shall involve the resident in addressing any machine problems that arise at the UMMC for any machine during the rotation assignment. If the problem requires a service engineer, the resident shall shadow the engineer until the problem is resolved. The staff physicist shall explain the rationale and demonstrate the performance of any QA tasks required after resolution of the problem before the equipment is released back into clinical use.

The staff physicist shall involve the resident in addressing any Pinnacle planning system problems that arise during the rotation assignment. If the problem requires a service engineer, the resident shall shadow the engineer until the problem is resolved. The staff physicist shall explain the rationale and demonstrate the performance of any QA tasks required after resolution of the problem before the equipment is released back into clinical use.

The staff physicist shall involve the resident in any In-Vivo dosimetry requests that arise during the rotation assignment. This includes:

- Placement of patient MOSFET Dosimeters
- Documentation of MOSFET locations relative to patient anatomy and treatment field
- Readout of dose received by MOSFET Dosimeters
- Preparation of all documentation required for billing or patient records

The staff physicist shall explain the rationale for and use of 4DCT imaging in radiation oncology. The staff physicist will explain and demonstrate procedures for 4DCT acquisitions. The staff physicist shall explain and demonstrate processing of 4DCT data and import of the data into Pinnacle. The resident will attend all 4DCT scan acquisitions that occur during the rotation assignment.

The staff physicist shall explain and demonstrate the procedures for performance of IMRT QA using the MapCheck, MapCHECK2, Delta4 and MatriXX dosimetry devices. This includes performance of the QA measurements, comparison of measured and calculated doses, generation of the IMRT QA report, and completion of any documentation required for billing or patient records. The resident shall perform IMRT QA for at least 10 patients per device during the rotation. The resident will perform these QA measurements with the UMMC staff physicist.

Resident documentation

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Copies of IMRT QA results and reports for these patients will be copied, with all PHI removed, and placed in the resident's binder for review.

The resident shall create a binder for documentation of all required materials for the rotation. For any linac or treatment planning problems that arise during the rotation assignment, the resident shall write a summary of the problem and the steps taken to resolve it. The resident shall document any QA tasks (reports and results) required before release of equipment into clinical use. The resident shall retain copies of all MOSFET measurement reports and results generated during the rotation assignment. All PHI must be removed. The resident shall create a procedure sheet documenting all the steps involved in 4DCT acquisition. The resident will document the number of observed 4DCT procedures during the rotation assignment. The resident will retain copies of all IMRT QA reports for patient QA performed with a staff physicist. All PHI shall be removed. The binder will be available for review by the supervising staff physicist and the Program Director.

The staff physicist shall explain and demonstrate the monthly QA procedures for the Elekta linear accelerators. This includes both mechanical, imaging and dosimetric tests where applicable. The staff physicist shall demonstrate preparation of all appropriate documentation and placement of documentation in appropriate data books.

Resident documentation

Documentation of monthly QA performance shall be maintained in the resident's rotation binder.

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Month 5: UMMC HDR Brachytherapy

The staff physicist shall explain and demonstrate the procedures involved in HDR treatment planning and delivery. This includes:

- Observation of applicator insertion
- Acquisition of treatment planning images
- Import of imaging data into the treatment planning system
- Contouring of relevant structures
- Identification of applicators
- Catheter reconstruction
- Positioning of dose calculation/optimization points
- Placement of normal tissue points (e.g., ICRU bladder and rectum points)
- Dose calculation and evaluation
- Export of approved treatment plan
- Performance of secondary dose check
- Pretreatment QA procedures
- Delivery of treatment
- Preparation of all documentation required for billing or patient records

The resident shall participate in the treatment planning and delivery process for all HDR patients during the rotation assignment. The staff physicist shall provide the resident with 15 practice cases (5 tandem and ovoid, 5 tandem and ring, and 5 cylinder). The resident will generate treatment plans for each case and present them to the staff physicist. The physicist shall evaluate and provide feedback on the plan for each case. Once the resident is able to generate clinically acceptable treatment plans, the resident will perform the rest of the treatment process (i.e., secondary dose check, pretreatment QA, and delivery) for each of these practice plans. A copy of each of these plans and all associated documentation will be kept in the resident's binder for the rotation.

The staff physicist shall explain and demonstrate the procedures for quarterly HDR source exchanges. This includes both mechanical and dosimetric tests where applicable. The staff physicist shall demonstrate preparation of all appropriate documentation and placement of documentation in appropriate data books.

Resident documentation

The resident will perform a practice source exchange and complete all procedures and documentation required for an actual source exchange. Documentation of source exchange performance shall be maintained in the resident's rotation binder.

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Month 6: UMMC Dosimetry

The staff dosimetrist and physicist will explain and demonstrate treatment planning procedures for the following treatment planning systems:

- Pinnacle
- VariSeed

The staff dosimetrist and physicist shall explain the rationale for various treatment parameters such as modality, beam energy, delivery technique (3DCRT, static beam IMRT, etc.), beam modifiers (wedges, blocks, etc.), selection of IMRT optimization parameters, review of dose limitations for various structures, selection of radionuclide for LDR planning, dose limits for various normal tissues, etc.

The staff dosimetrist and physicist shall explain and demonstrate all procedures for treatment planning.

For external beam planning, this includes:

- Creation of patient file in treatment planning system
- Import of imaging data (CT, MRI, PET)
- Removal of CT couch
- Image fusion
- Contouring of structures
- Selection of isocenter
- Selection of treatment modality
- Selection of beam orientations
- Selection of beam energies
- Use of beam modifiers (wedges, blocks, etc.)
- Creation of MLC and block shapes
- Selection and positioning of reference calculation point
- Entering of prescription
- Selection of dose grid
- Verification of correct dose voxel size
- Verification of correct CT-to-density table
- Verification of external contour density threshold
- Selection of correct dose algorithm
- Evaluation of plan for clinical acceptability

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- Export of plan
- Creation of data required for IMRT QA
- Import of plan into R&V system (MOSAIQ)
- Appropriate documentation for billing and patient records

For LDR brachytherapy planning, this includes:

- Creation of patient file in treatment planning system
- Acquisition of ultrasound images
- Import of imaging data
- Contouring of structures
- Selection of seed radionuclide
- Placement of seeds
- Calculation of dose
- Evaluation of plan for clinical acceptability
- Appropriate documentation for billing and patient records

The resident shall observe the treatment planning process for a number of anatomic locations during the rotation assignment. The minimum number for each anatomic site and planning system is listed below.

Pinnacle

- 1 lung with off-cord
- 2 breast (1 3DCRT; 1 forward-planned IMRT)
- 2 GU (1 3DCRT; 1 IMRT)
- 2 GYN (1 3DCRT; 1 IMRT)
- 2 GI (1 3DCRT; 1 IMRT)
- 2 head and neck (1 3DCRT; 1 IMRT)
- 1 lymphoma
- 1 melanoma
- 1 pediatric
- 1 sarcoma
- 1 thoracic
- 2 brain (1 3DCRT; 1 IMRT)
- 2 palliative or non-malignancy treatments (e.g., cord compression, heterotopic bone)

VariSeed

- 1 prostate

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For the 1 prostate seed implant, the resident shall be present for seed implantation. The resident will participate in needle loading, seed count documentation, post-implant survey, etc.

Resident documentation

The resident will generate practice treatment plans for 14 cases (1 from each of the Pinnacle anatomic groups and 1 prostate seed plan) and present them to the staff dosimetrist and physicist. The dosimetrist and physicist shall evaluate and provide feedback on the plan for each case. Once the resident is able to generate clinically acceptable treatment plans, a copy of each of these plans and all associated documentation (with PHI removed) will be kept in the resident's rotation binder for review by the dosimetrist and Program Director.

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Sample schedule and sample description of resident independent projects

UMMC Residency Program Project Rotation

Rotation 1: July 2016 – October 2016 **Imaging**

Project Description:	Mentor:
CT acceptance and commissioning	Stanford
IGRT commissioning Part I: XVI	Lu
IGRT commissioning Part II: EPID	Lu

Rotation 2: November 2016 – February 2017 **Measurements/HDR/LDR**

Project Description:	Mentor:
Dosimetric Systems	Yang
HDR program & TPS commissioning	He
LDR program & TPS commissioning	Stanford

Rotation 3: March 2017 – June 2017 **Machine QA**

Project Description:	Mentor:
Linear accelerator acceptance testing	Stanford
Collect commissioning data for one photon and one electron energy	Stanford
Perform annual quality assurance on a conventional linac	Stanford
MLC commissioning and quality assurance for IMRT	Yang

Rotation 4: July 2017 – October 2017 **Special Procedures**

Project Description:	Mentor:
SFRT program commissioning	Duggar
Total Body Irradiation commissioning	Yang
Intraoperative therapy commissioning	Yang

Rotation 5: November 2017 – February 2018 **Treatment Planning**

Project Description:	Mentor:
Commission one photon and one electron energy in Pinnacle	Stanford
Commission MU Check program for one photon and one electron energy	He
Commission SFRT Planning System	Stanford

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Rotation 6: March 2018 – June 2018 **Radiation Safety**

Project Description:	Mentor:
Linac room design and shielding	Yang
Radiation area survey	Yang
Survey meters	He
CT Shielding	Duggar
HDR Shielding	He
State and federal radiation safety regulations	Yang
Personnel monitoring program	Yang
Sealed source leak testing and inventory	Stanford

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Sample Project

Commissioning (Verification) of COMS Eye-Plaque Planning Using Point Source (Excel Worksheet and Pinnacle TPS) and Line Source (Brachyvision)

04/04/2016 to 05/03/2016
Mentor: Jason Stanford

Project Description: The resident should learn the principle and practice related to Eye Plaque planning.
Learning Objectives:

- Understand the concept behind brachytherapy TPS seed model and dose calculation.
- Understand how Brachyvision may be used for non-HDR planning.
- Know the steps in commissioning TG-43 line source in Brachyvision TPS.
- Understand the limitation and assumption of the COMS Eye-Plaque model.
- Understand and implement the recommendations of TG-129.

The following tasks should be completed:

1. Verify the correctness of the coordinates for all available eye plaque sizes in both Excel worksheet and Pinnacle TPS
2. Verify the published TG-43 data for I-125 IsoAid seeds using the line source model in Brachyvision
3. Perform literature search on how other clinic(s) may have implemented TG-129.
4. Comparing the planning results of the Brachyvison line source model against currently used Excel planning spreadsheet.

At the end of this project, a full report should be submitted detailing the verification results.
Recommended reading materials:

1. AAPM TG-56 Code of Practice for Brachytherapy (1997)
2. Brachytherapy Physics AAPM Summer School 1994
3. AAPM TG-129 New Recommendation for COMS Eye-Plaque protocol
4. Brachytherapy Physics – 2005 AAPM Summer School-2nd Edition
5. Brachytherapy Physics, R. Nath, J. Williamson, and B. Thomadsen, Med.Phys Publishing. ISBN: 0-944838-50-2
6. Varian Brachyvision Manual
7. A. Nguyen, Y. Hu, R. He, T. Paul, A. Plowman, P. Mobit, J. Ma, S. Packianathan, M. Kanakamedala, C. Yang, TG-129 Implementation On Brachyvision, *Medical Physics*, Vol 41 (6), 321, 2014