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BRIEF REPORT

Medical Student Perspectives on a Multi-institutional Clerkship Curriculum: A Report From the Radiation Oncology Education Collaborative Study Group

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Table 1 Consistent positive and negative feedback themes for individual curriculum components and how the curriculum will or will not be useful for transition to residency and for the overall curriculum

Radiation oncology overview	
Useful features	Suggested changes
• Excellent overview and introduction to radiation oncology; no changes necessary • Historical perspective of radiation oncology • Radiation oncology care path • Radiation oncology history and physical	• Lecture pacing and depth based on students' interest and knowledge level • References for additional reading • Individualize lecture content to the institution • Use case examples to demonstrate workflow • Describe role and training of each member of radiation oncology team
Radiobiology and physics fundamentals	
Useful features	Suggested changes
• Excellent overview of basic terminology and concepts of radiobiology and radiation physics, no changes necessary • Alpha/beta ratio and fractionation • Understanding dose-volume histogram	• Split radiobiology and radiation physics into separate lectures • Present essential information only to reduce lecture content • Allow additional time for difficult concepts such as alpha/beta ratio, normal tissue tolerance, serial vs parallel organs, isocenters, and isodose lines • Use videos for explanation of difficult concepts
Practical aspects of simulation, planning, and radiation emergencies	
Useful features	Suggested changes
• Excellent overview of topic; no changes necessary • Radiation emergencies • Radiation simulation and field setup and terminology • Use of case-based format	• Split into two lectures • Increase content on management of emergencies and case-based discussions • Use sample videos of positioning
Treatment planning workshop	
Useful features	Suggested changes
• Interactive hands-on nature; no changes necessary • Most important session	• Additional assignments for self-practice • Allow the student to work on the plan instead of attending a lecture demonstration • Independent workstation for each student • Elaborate on directions if supervision is not available for an explanation of the software's actions • Introduction to more complex planning examples • Explain isodoses
Overall curriculum evaluation	
Useful for residency	Not useful for residency
• Excellent foundation for transition to residency	• May not retain information due to the time gap until the start of residency
Strengths	Weaknesses
• Excellent overview of basic principles and terminologies • Hands-on treatment planning session was the most important session • Organized framework of the course/slides • Interactive one-on-one lectures • Lecturer enthusiasm	• Plan lectures in the early part of the rotation • Handouts to be made available for pre- and post-lecture reference • Abbreviate or split lectures 1-3 with opportunity for added elaboration of difficult concepts • Tailor a more advanced version for students with previous radiation oncology knowledge • Increase interactive component in lectures 1-3 • Administer evaluation after each lecture for that lecture

Medical students applying for radiation oncology residency rated "perceived quality of didactics" within the top 5 factors in ranking programs (1). However, according to a 2013 national survey, only 27% of radiation oncology clerkships included didactic components specifically for medical students (2). In 2012, a pilot radiation oncology clerkship curriculum was developed at two institutions using the six-step conceptual framework for medical education curriculum development by Kern et al (3). Eighteen students completed the pilot curriculum. Students rated the curriculum highly and reported improved comfort with their decision to pursue radiation oncology as a specialty (4). Using the cooperative group research model, the curriculum was expanded to 11 selected academic medical centers within the United States in 2013 with the goal of increasing the number of participating students to provide more robust feedback for further curriculum development. Here, we describe the structure of the curriculum with corollary student feedback that can be used by other institutions to design or enhance their medical student curriculum.

The curriculum consisted of three 1-hour lectures delivered by a senior resident or faculty member; topics included: (*1*) an overview of radiation oncology, including a history of the specialty, types of treatments, and basic clinic flow; (*2*) fundamentals of radiation biology and radiation physics; and (*3*) practical aspects of radiation treatment simulation and planning and radiation emergencies. Ideally, one session was conducted per week with all students present. The lecture format was open, and students were encouraged to ask questions.

In addition, a 1-hour hands-on radiation treatment workshop facilitated by a senior resident, faculty, physicist, or dosimetrist was implemented to teach students the fundamentals of radiation treatment planning (5). While using a radiation treatment planning workstation, each student was provided with a step-by-step guide to delineating a radiation target, selecting appropriately directed radiation beams, and modifying various beam parameters to achieve an optimal plan. Individual institutions were encouraged to adapt the lectures according to institutional treatment or practice patterns, but all institutions retained the core curriculum format (3 lectures, 1 planning session). All participating institutions obtained institutional review board exemption.

A total of 94 students participated in the curriculum in the 2013 academic year, allowing both wide dissemination and robust feedback. Upon completion of the clerkship, students were invited to complete an anonymous internet-based survey to rate the curriculum components, which yielded a 73% response rate.

Qualitative analysis of the evaluations was undertaken by two authors (P.M. and J.C.Y.). Evaluation-free responses were reviewed independently and divided into positive and negative "consistent" themes (Table 1). These themes reflected the students' subjective overall feeling that the course laid an excellent knowledge foundation for transition to residency and their concern that they might not retain the knowledge during the two years prior to beginning residency. Future directions for curriculum development include expansion to additional institutions while using these constructive comments to enhance the learning experience. For example, one negative theme was that lectures should be scheduled earlier in the rotation to ensure that students have a good knowledge base for the remainder of the clinical rotation. This and other constructive feedback will be considered in the future when implementing the curriculum.

This successful implementation of a standardized curriculum piloted at multiple institutions provides proof-of-principle that curriculum development can follow the multi-institutional cooperative group model. In the process, we identified areas of positive and negative needs as perceived by the students, who represent the most important stakeholders. Additional data are being collected to assess the impact of this curriculum on the students' decision to apply for radiation oncology residency. In the interim, the current data can help individual departments enhance their ongoing curriculum for rotating medical students.

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