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Brief Opinion

Integrating Radiation Oncology Into Undergraduate Medical Education

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Abstract

Cancer is one of the most important public health problems. However, medical education has not advanced at the same rate when it comes to cancer education. Currently, the United States Medical Licensing Examination subject examinations do not cover radiation oncology, prevention, and survivorship planning in its assessment model. Incorporating medical oncology and radiation oncology training into the undergraduate medical education curriculum can have a significant benefit in training future physicians. In this paper, we review current literature and propose some ideas that can help incorporate oncology, and specifically radiation oncology, into undergraduate medical education.

Introduction

Medicine is an ever-evolving field. However, medical education and learning assessment have not advanced at the same rate when it comes to educating medical students about cancer. Currently, the United States Medical Licensing Examination, which establishes a baseline for core knowledge, does not cover radiation oncology, cancer prevention, and survivorship planning in their assessment model.[1] Incorporating clinical oncology training, including radiation oncology, into the undergraduate medical education (UME) curriculum could have a significant benefit in training future physicians.

Cancer is one of the most important public health problems facing the United States, with an estimated 1,806,590 cancers diagnosed and over 600,000 deaths in the United States in 2020. The current lifetime cancer probability in the United States is approximately 38.7% in females and 40.1% in males.[2] In 2017, cancer was the second leading cause of death after cardiac disease. Fortunately, advances in cancer care have allowed an ever-growing proportion of patients to be cured of cancer. It is estimated that by the year 2030, there will be around 22 million cancer survivors living in the United States.[3] As the population of cancer survivors continues to grow, there is an ever-expanding cohort of patients who are more than 5 years out from diagnosis and treatment of their cancer and an ever-growing population of survivors over the age of 65.[3] This growing population highlights the importance of physicians' knowledge about clinical diagnosis, treatment, and survivorship care of patients

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with cancer, regardless of their specialty and career stage. In this paper, we will review the current literature and propose some ideas that can help incorporate oncology, and specifically radiation oncology, into UME.

Medical Schools Lack a Standard Oncology Curriculum

Oncology education is widely variable in the preclinical years. There is not an American Association of Medical Colleges (AAMC) requirement for clinical exposure to oncology in medical school.[4] A survey of U.S. medical students who attended the American Society of Radiation Oncology or AAMC annual conferences showed a wide variety in oncology teaching per year. The most frequently reported amount was 6 to 10 hours during the first year, 16 to 20 hours during the second year, and 6 to 10 hours during the third year of medical school. In addition, students reported less confidence in understanding cancer treatment compared with diagnosis and workup.[5] Another survey done at the University of Chicago and the University of California, San Francisco, showed that only 61% of students completed a clinical oncology clerkship and 4% of MS3s and 7% of MS4s completed a radiation oncology rotation.[6] Not surprisingly, students were less comfortable with radiation oncology and survivorship care compared with medical and surgical oncology.

The lack of exposure to clinical oncology and specifically radiation oncology is not a problem confined to the United States. For example, a recent study of graduating medical students in Australia found that approximately 1 in 3 responders had no clinical exposure to medical oncology, and less than 50% of students had any dedicated radiation oncology lectures. Students who did receive dedicated radiation oncology lectures reported having only 1 to 2 hours of lectures. Students reported no-to-low confidence in explaining radiation techniques and over one-third of medical students thought that the patients would be radioactive after receiving external beam radiation therapy.[7] Unfortunately, there has been a significant rise in the number of students in Australia with no exposure to clinical oncology, from 18% in 1990 to more than 46% in 2001,[8] and it is no surprise that faculty members in Australia have reported similarly low rates of exposure to radiation oncology in their training (6%).[9]

The Importance of Oncology Education

Radiation oncology is a relatively small specialty, but it is estimated that around 50% of patients with cancer receive radiation therapy, and 40% of cancer cures are achieved with this modality.[10] Because cancer is increasingly prevalent and radiation plays a large role in overall cancer care, a basic understanding of the principles of radiation treatment and the potential long-term effects is important for all medical professionals.

Although a minority of students will enter an oncology specialty, the lack of oncology education during UME can affect all physicians in their future jobs. A nononcology health care provider is the first person to suspect a diagnosis of cancer and initiate workup and referral to a specialist. A basic understanding of oncologic principles and cancer provider roles for appropriate referral is therefore critical for all physicians. In addition, with the need for long-term surveillance of cancer survivors, primary care physicians (PCPs) and other specialists are often involved in survivors' long-term follow-up. This includes the management of long-term toxicities, screening for secondary malignancies, and providing psychosocial support. In a study assessing PCPs' knowledge and comfort with managing follow-up of colon cancer survivors, 40% expressed confidence about performing tests to detect cancer recurrence, and only 20% were confident managing the late physical effects of cancer and treatment.[11] This study also found that two-thirds of PCPs deviated substantially from guidelines in recommending tests for cancer survivors. This lack of confidence and knowledge could be improved by providing increased exposure during medical school. Although internists are required to do an oncology rotation during residency and medical oncology represents around 6% of the internal medicine board questions, there remain challenges to high quality oncology education due to short rotations and limited exposure to outpatient care for residents.[12]

Challenges of Incorporating Oncology in Undergraduate Medical Education

Incorporation of radiation oncology into the UME curriculum has its own set of challenges. Radiation oncologists are less likely to be involved with medical school didactics, and only 40% of radiation oncology departments affiliated with a medical school have a faculty member involved in curricular education sessions.[5,13,14] This is more challenging at medical schools that do not have a radiation oncology department. Incorporating radiation oncology into the curriculum, particularly in the preclinical years, requires creative solutions and invested faculty champions. Without the expertise of a radiation oncologist involved in curriculum development this is unlikely to happen.

Current Preclinical Oncology Initiatives

The European School of Oncology initiated a program for medical students that entailed a 5-day summer course aiming to improve oncology knowledge. Students

expressed great satisfaction and interestingly, 50% of these students participated without a career decision, meaning they were still exploring to make a decision about their future specialty.[15] This experience exposed medical students to a new field. It also improved their overall experience and competency.[16] Another approach that has been evaluated is designing a novel radiation oncologist-driven tumor board shadowing experience.

The Cancer in the Under Privileged, Indigent or Disadvantaged program is a summer research program for rising second year medical students. The program includes a longitudinal laboratory research experience, daily lectures, and clinical shadowing with radiation and surgical and medical oncology. In the first 10 years of the program, Cancer in the Under Privileged, Indigent or Disadvantaged students were 4 times as likely to enter oncology, and 10 times as likely to enter radiation oncology compared with their peers nationally.[17] A similar program at The University of Chicago conducted a pilot structured program integrated into a pre-existing medical student summer research experience. The Scholars in Oncology-Associated Research consisted of structured didactics, multidisciplinary tumor board attendance and interprofessional shadowing. This course improved self-reported understanding of clinical and research oncology.[18] Several additional programs are summarized in Table 1.[19-24]

Current Clinical Oncology and Radiation Oncology Specific Initiatives

Most radiation oncology departments associated with a medical school offer a clinical rotation in radiation oncology. Based on the AAMC website,[25] there are currently 155 accredited medical schools in the United States. However, only 85 (54%) medical schools have a radiation oncology department with a residency program.[26] Historically, an ambulatory, multidisciplinary oncology rotation was developed at the University of Cincinnati in 1992, and a survey of previous participants found that for half of students the rotation was their first exposure to clinical oncology, and for over two-thirds of participants it was their first exposure to radiation oncology.[27] This program is housed and administered in the department of radiation oncology, and 74% of the students who ultimately entered oncology are practicing as radiation oncologists.

Radiation Oncology Virtual Education Rotation is a virtual multi-institutional platform developed in the coronavirus disease era to engage medical students in review of cases and discussion of treatment options.[28] In addition to lectures, the Radiation Oncology Virtual Education Rotation platform has helped support many virtual "away rotations" and networking events for students interested in radiation oncology. The Harvard radiation oncology program also developed the virtual Radiation Oncology Intensive Shadowing Experience for fourth year medical students from under-represented backgrounds.[29] This 1-week intensive experience included foundational exposure to radiation oncology, participation in clinical encounters, and mentorship.

Another innovative approach was piloted at Thomas Jefferson University, where students could complete a 3-week radiation oncology elective as part of their surgery core clerkship. Students who completed the elective had

Table 1 Current initiatives in oncology training for medical students

Program	Eligibility	Summary
MD Anderson Summer Program[20]	First-year Medical Science (MS)	10-wk research program with lectures and shadowing opportunity
University of Kansas (KU) Radiation Oncology Summer Program[21]	Undergrad or MS	8-wk research program
Jefferson Simon Kramer Summer Externship[22]	First- and second-year MS	6-wk research opportunity with stipend in addition to participating in educational opportunities
St Jude Pediatric Oncology Education program[23]	Undergrad or MS	10-11 wk summer research program
Roswell Park Summer Program[24]	First-year MS	Research with mentorship opportunities
CUPID[19]	First-year MS	10-wk lab-based research experience, daily didactics, clinical shadowing
ROVER[28]	All MS	Online educational resources including webinars, virtual away rotations
RISE[29]	Senior UIM MS	1-wk program with participation in educational activities, tumor boards, chart rounds, and mentorship opportunities

Abbreviations: CUPID = Cancer in the Under Privileged, Indigent or Disadvantaged; MS = medical student; RISE = Radiation Oncology Intensive Shadowing Experience; ROVER = Radiation Oncology Virtual Education Rotation; UIM = under-represented in medicine.

improved oncology knowledge and rated the rotation as highly useful.[30]

A Proposal for Radiation Oncology Specific Undergraduate Medical Education Integration

Radiation oncology can be incorporated across the medical school curriculum to address the core competencies proposed by the Accreditation Council for Graduate Medical Education, as outlined in Table 2. In this section, we highlight a few aspects that can be incorporated that have not been discussed in ongoing initiatives.

In the preclinical years, we propose the introduction of radiation oncology through incorporation of radiation biology and physics in the existing basic science and oncology curriculum. In addition, radiation oncology can be part of clinical preceptorship, courses on evidence-based medicine, and courses on foundations of clinical medicine.

In the core clinical curriculum, radiation oncology could be incorporated in many ways. A required clinical radiation oncology experience is not feasible or necessary. However, students can gain exposure and knowledge through interactions at multidisciplinary tumor boards and case-based learning on core rotations.

To improve communication skills, oncotalk workshops with small group discussion and standardized patients can be added to the core clinical curriculum. Oncotalk is a communication skills training workshop with a focus on delivering bad news and transitioning to palliative care that was first designed for oncology fellows by Back et al.[31] This workshop can also be used for medical students to improve communication skills. We also propose teaching students about possible toxicities of treatment modalities and effective ways to improve patients' quality of life. It is also important to discuss the cost-benefit assessment of treatment modalities.

As radiation oncologists, it is important to be involved with medical school didactics, to inspire medical students and give them the opportunity to learn and experience the field of radiation oncology. It is also important to be innovative and use any opportunity to teach about cancer care.

Why Are Radiation Oncologists Still Stuck in the Basement?

In this article, we have outlined specific proposals for ways radiation oncology can be integrated into the UME curriculum across the preclinical and clinical years. However, many of these concepts are not novel and have been reported on in various forms before. This begs the complicated question: why are radiation oncologists still stuck in the basement?

One reason for the lack of radiation oncology in the UME curriculum is the lack of radiation oncology faculty engaged in teaching outside their departments. A potential driver of this lack of involvement is a misalignment of incentives. As relative value unit-based compensation has become more common in the academic setting, teaching has largely fallen to the realm of uncompensated time. This problem is not specific to radiation oncology

Table 2 Quality cancer care thread concepts

Phase of training	ACGME core competency	Content
Preclinical	Medical knowledge	• Introduction to radiation oncology • Incorporation of radiation biology and physics • Summer research opportunities (clinical, basic, translational) • Oncology case-based learning
	Patient care	• Tumor board participation • Clinical shadowing
	Practice-based learning and improvement	• Use oncology studies or trials in evidence-based medicine courses • Use oncology examples for lectures on epidemiology
Core clinical	Practice-based learning and improvement	• Evidence-based medicine • Case studies
	Patient care	• Introduction to multidisciplinary care in oncology patients • Discussing care with standard patients
	Professionalism	• Introduction to disparities in cancer
	Medical Knowledge	• Highlighting short- and long-term toxicities of cancer treatment with focus on possible interventions to improve quality of life
	Interpersonal and communication skills	• Oncotalk workshop
	Systems-based practices	• Survivorship principles • Disparities in cancer care • Cost-benefit assessment of treatment modalities

Abbreviation: ACGME = Accreditation Council for Graduate Medical Education.

and is being grappled with in other specialties.[32,33] An additional concern for radiation oncology faculty is weighing the balance of clinical work, research, and education with respect to promotion and tenure. Compared with research physicians, clinical physicians are already less likely to hold a higher clinical rank, and physicians devoting >50% of their time to clinical work are more likely to be on a nontenure track.[34] Clinician educators have not traditionally had a clear path to promotion and tenure, but many schools are actively reviewing and adapting their processes.[34,35] Realignment of incentives to value the contribution of educators in radiation oncology will require a coordinated effort from department chairs (compensation, protected time) and medical schools (compensation, promotion/tenure). Education is 1 of the 3 pillars of the tripartite mission of medical education and should be valued in all departments of medical schools.

Another potential avenue to improve the involvement of radiation oncologists in medical education is to foster and encourage scholarship around education. Despite regular involvement of oncologists in medical training at most medical schools, there is a relative paucity of rigorously tested frameworks or interventions for teaching oncology to medical students.[36] Medical education has been rapidly shifting to focus on milestones and competencies[37]; oncology education needs to embrace these changes and explore avenues to integrate oncology principles into overarching themes of medical education. Efforts to implement and test new teaching strategies for oncology education should be encouraged and celebrated.

Conclusions

We believe that oncology education, and specifically radiation oncology, should be incorporated into the UME curriculum through active participation of radiation oncology clinical educators. This will require support from departmental and school leadership. Furthermore, we have outlined specific ways that radiation oncology can be incorporated to advance the core competencies proposed by the Accreditation Council for Graduate Medical Education across the medical school curriculum. Improving students' knowledge of cancer care, and specifically radiation oncology, could improve their ability to care for patients with cancer, regardless of their ultimate specialty choice.

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