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Scientific Article

The Declining Residency Applicant Pool: A Multi-Institutional Medical Student Survey to Identify Precipitating Factors



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Abstract

Purpose: The purpose of our study was to better understand and identify concerns that may be responsible for the declining radiation oncology (RO) residency applicant pool.

Methods and Materials: All RO residency programs affiliated with a US medical school were asked to participate in the study survey. An optional and anonymous survey consisting of 12 questions was emailed to all graduating medical students in 2020 at the 12 allopathic medical schools that agreed to survey administration. Survey responses were collected from March to May 2020.

Results: The study consisted of 265 survey responses out of 1766 distributed to eligible medical students, resulting in a response rate of 15.0%. The majority of students reported no exposure to RO (60.8%) and never considered it as a career option (63.8%). Neutral perceptions of the field were more common (54.3%) than positive (39.6%) and negative (6.0%). The top factors attracting medical students to RO were perceptions of high salary, favorable lifestyle and workload, and technological focus. The top negative factors were the field's interplay with physics, competitive United States Medical Licensing Examination board scores for matched applicants, and the focus placed on research during medical school. In the subgroup of students who were interested in RO but ultimately applied to another specialty, the job market was the most salient concern.

Conclusions: Finding a place for RO in medical school curricula remains a challenge, with most surveyed students reporting no exposure during their education. Concern over the job market was the primary deterrent for medical students interested in pursuing RO. For disinterested students who had not considered RO as a career option, the required physics knowledge was the main deterrent.

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Research data can be shared upon request to the corresponding author.

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Introduction

For much of the past 3 decades, radiation oncology (RO) has been perceived as a small, highly specialized, and technology-centric discipline with a very competitive bar to entry. Until not long ago, there was a degree of equilibrium between the number of applicants and available resident positions.¹ With the expansion of RO training programs over the past decade in concert with declining medical student interest, a notable percentage of positions have been left unmatched. This has led to an increased number of positions being filled via the Supplemental Offer and Acceptance Program.²

From 2014 to 2018, the RO applicant pool was steady, with around 190 US senior allopathic applicants per year, until an abrupt drop in the 2019 Main Residency Match.³ This plunge resulted in a 14.5% unmatched rate, the highest by double in 10 years.⁴ In the most recent 2019/2020 application cycle, US allopathic applicants decreased to 128 from 163 the preceding year, giving rise

to a total unmatched rate of 18.3%, before the Supplemental Offer and Acceptance Program.^{3,4}

Multiple factors may account for the higher unfilled rates, including new and expanding residency programs, an observed reduction in applications, and an increased number of ranks per applicant.⁵ This study was undertaken to better understand the perceptions of medical students in hopes of identifying salient concerns and factors that may be responsible for the declining applicant pool.

Methods and Materials

This was a survey research study approved by the institutional review board. All RO residency programs affiliated with a US medical school were asked to participate in the survey. An e-mail describing study details was sent to the dean of student affairs or an associated contact. Of 76 medical schools contacted, 36 (47.4%)

Table 1 Survey distributed to fourth year medical students

Type of question	Question	Answer
Open ended	1. What medical school do you attend?	
Fixed response	2. What type of degree are you pursuing?	MD, MD/PhD
Fixed response	3. What is your gender?	Female, male, other
Fixed response	4. What is your race or ethnicity?	White, Hispanic/Latino/Spanish, Black/African American, Asian/Asian Indian, Native American, Middle Eastern, other, prefer not to say
Fixed response	5. What specialty did you apply into?	Anesthesiology, dermatology, emergency medicine, family medicine, internal medicine, IM PEDS, neurosurgery, neurology, OB/GYN, ophthalmology, orthopedic surgery, otolaryngology, pathology, pediatrics, PMR, plastic surgery, psychiatry, radiation oncology, radiology, general surgery, thoracic surgery, urology
Fixed response	6. Did you have exposure to radiation oncology during medical school?	No, yes from medical school curriculum or lecture, yes from a clinical rotation
Fixed response	7. Did you consider radiation oncology as a future career?	Never, rarely, occasionally, frequently
Fixed response	8. What is your general perception of radiation oncology as a field?	Positive, neutral, negative
Open ended	9. Please explain or specify your answer to question #8	
Checkbox select all	10. What do you consider to be positive aspects of radiation oncology?	Research, lifestyle/resident workload, level of physician burnout, patient population, focalized specialization, size of field, salary, job market, technology, physics, length of training, other
Checkbox select all	11. What do you consider to be negative aspects of radiation oncology?	Research, lifestyle/resident workload, level of physician burnout, patient population, focalized specialization, size of field, salary, job market, technology, physics, applicant board scores, length of training, other
Open ended	12. What are your reservations about pursuing a career in radiation oncology?	

Abbreviations: IM PEDS = internal medicine-pediatrics; OB/GYN = obstetrics and gynecology; PMR = physical medicine and rehabilitation.

replied and 12 (15.8%) agreed to distribute the survey to their graduating class of 2020.

The survey was created via Google Survey and consisted of 12 fixed-response and open-ended questions (Table 1). Anonymity and optionality of the survey were emphasized. Respondents could willingly indicate their medical school in question 1. The remaining 10 questions were required for submission. Questions 2 through 5 consisted of fixed-response items requesting demographic information. Questions 6 and 7 inquired about level of exposure to RO. Questions 8 through 11 contained fixed-response, checkbox, and open-ended questions regarding the respondent's perception of RO. Question 12 was open-ended and provided an opportunity for free text opinions.

Survey links were sent to medical students after the National Resident Matching Program (NRMP) rank list due date on February 26, 2020. Responses were collected from March through May 1, 2020. The survey was e-mailed to the students twice in an attempt to maximize response rates.

Results

The study analysis included 265 survey responses out of 1766 distributed to eligible medical students, resulting in a response rate of 15.0%. The majority of respondents were MD graduates (97.4%); 56.6% were female and 67.2% were Caucasian. A diverse group of specialty interest was represented in the participating cohort, with the highest representation from internal medicine (17.7%), followed by pediatrics (11.3%), and family medicine (10.2%) applicants (Table 2). Fifty-five percent (145/265) of the survey responses were collected after the NRMP Match Day. Five out of 7 RO applicants responded to the survey after Match Day.

Our analysis revealed that 60.8% of surveyed students had no exposure to RO during their medical school training (Fig 1). Most (63.8%) never considered RO as a career choice, 23.0% rarely, 7.2% occasionally, and 6.0% frequently did. Neutral perceptions (54.3%) of RO were more prevalent than positive (39.6%) and negative (6.0%). The top factors attracting medical students included perceptions of high salary, favorable lifestyle and workload, technological focus, and narrow specialization. Open-ended survey answers further recognized the field to be rewarding and commended the radiation oncologist's active role during tumor boards. The most frequent perceived negative factor was the prerequisite of physics knowledge, followed by competitive United States Medical Licensing Examination Step 1 board scores for matched applicants, focus on research during medical school, and the perception of a challenging job market (Figs 2 and 3). For those dissuaded by physics,

Table 2 Demographics of surveyed medical students

Demographic	Medical student respondents n = 265 (%)
Degree	
MD	258 (97.4)
PhD	7 (2.6)
Gender	
Male	115 (43.4)
Female	150 (56.6)
Race or ethnicity	
White	178 (67.2)
Hispanic, Latino, or Spanish	14 (5.3)
Black or African American	8 (3.0)
Asian or Asian Indian	37 (14.0)
Native American	0 (0)
Middle Eastern	6 (2.3)
Other	15 (5.7)
Prefer not to say	7 (2.6)
Specialty applied into	
Anesthesiology	16 (6.0)
Dermatology	2 (0.8)
Emergency medicine	22 (8.3)
Family medicine	27 (10.2)
Internal medicine	47 (17.7)
IM PEDS	8 (3.0)
Neurosurgery	4 (1.5)
Neurology	7 (2.6)
OB/GYN	19 (7.2)
Ophthalmology	8 (3.0)
Orthopedic surgery	7 (2.6)
Otolaryngology	6 (2.3)
Pathology	4 (1.5)
Pediatrics	30 (11.3)
PMR	3 (1.1)
Plastic surgery	6 (2.3)
Psychiatry	12 (4.5)
Radiation oncology	7 (2.6)
Radiology	18 (6.8)
General surgery	9 (3.4)
Thoracic surgery	0 (0)
Urology	3 (1.1)

Abbreviations: IM PEDS = internal medicine-pediatrics; OB/GYN = obstetrics and gynecology; PMR = physical medicine and rehabilitation.

about 70% (81 of 116) were women and 56% (65 of 116) had no previous exposure to RO. Of the students who "occasionally" and "frequently" considered RO as a career option (35 of 265 [13.2%]), 74.3% (26 of 35) identified the job market to be negative, making it the most common concern (Table 3). It was frequently thought that postdoctoral training or additional research time was critical for acceptance into the field. Other recurring deterrents included a perceived lack of hands-on procedures, lack of longitudinal care, and concerns over radiation toxicity after treatment.

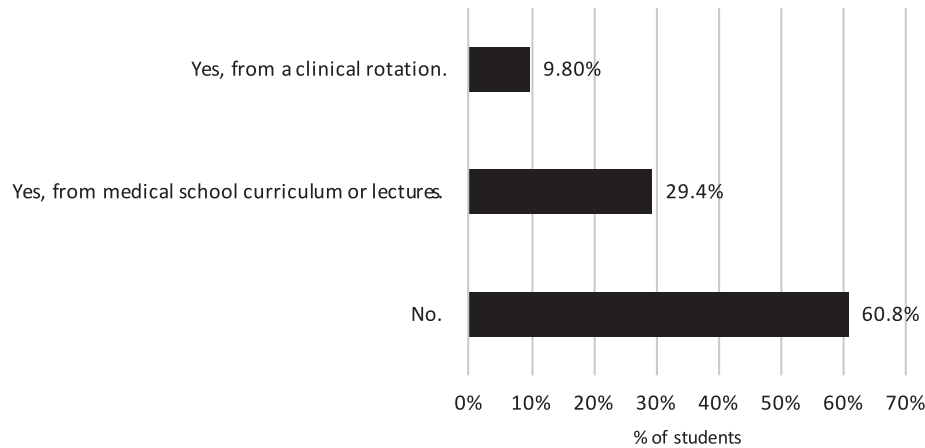


Figure 1 Did you have exposure to radiation oncology in medical school?

Discussion

To our knowledge, this is the first multi-institutional survey of allopathic medical student NRMP match applicants that has investigated precipitating factors that may be responsible for the dramatic and continued drop of RO residency applicants over the past few years. The perceived job market was the primary concern for students who considered the field of RO but ultimately applied to a different specialty. In students lacking interest and exposure, the required physics knowledge was the principal deterrent.

The limited presence of RO in medical school curricula has previously been identified as a problem and remains a challenge for the specialty.⁶ The majority of attention has been focused around standardizing a national curriculum

for medical students during their clerkship, at which point most students have already decided to apply for RO residency.⁷ Aside from The Oncology Education Initiative at Boston University, there is scant literature to suggest active efforts directed at increasing RO exposure during the preclinical or early clinical years of medical school.⁸ The creation of similar program initiatives to integrate RO into the required curriculum should be encouraged to strengthen exposure to the field. Although curriculum varies greatly among medical schools, dedicated RO didactics could be included in modules regarding carcinogenesis, ambulatory and radiology rotations, or time devoted to career and specialty exploration.

Matters regarding job opportunities after residency training are a frequent subject of discussion among RO residents.⁹ Aside from Internet forum discussions and

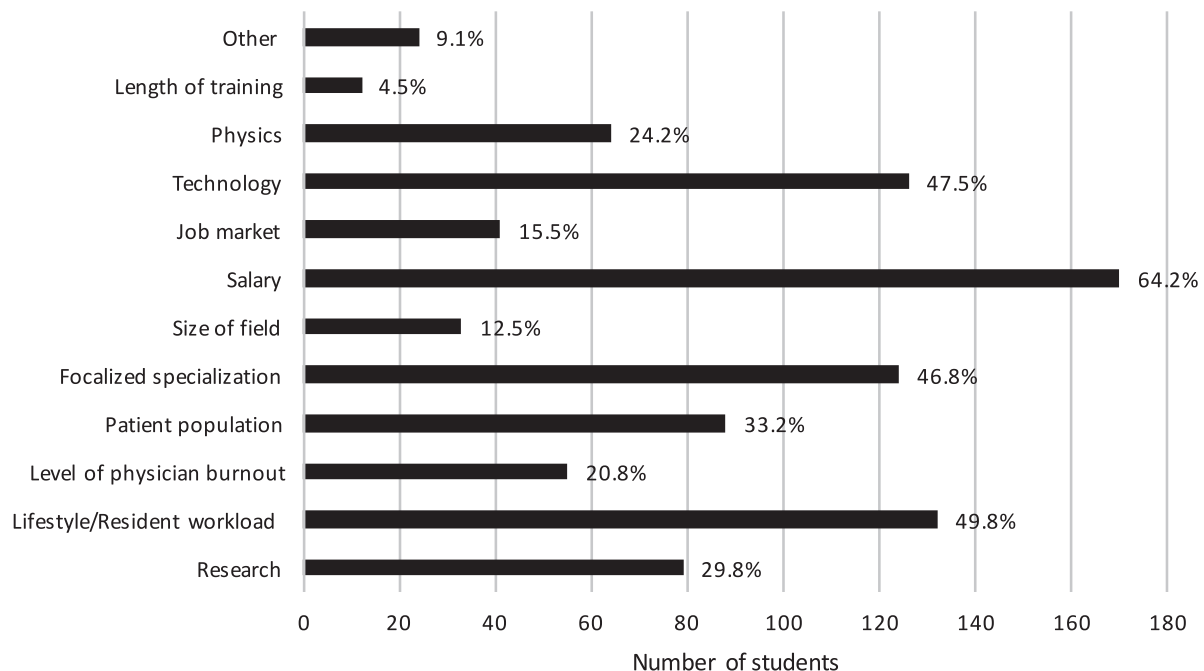


Figure 2 What do you consider to be positive aspects of radiation oncology?

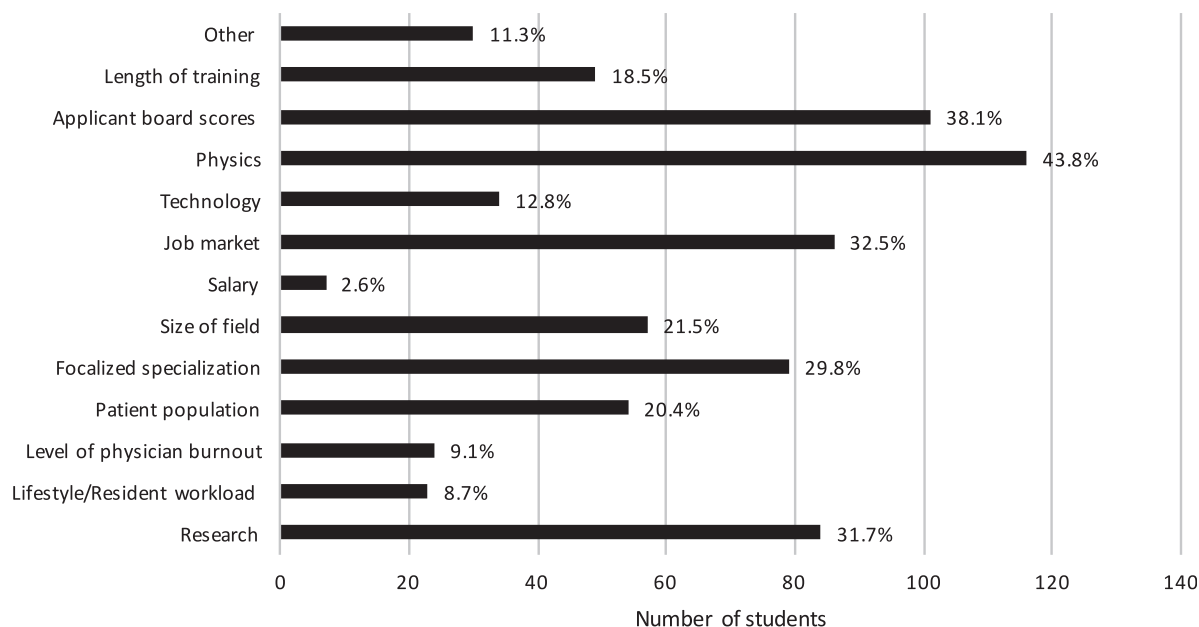


Figure 3 What do you consider to be negative aspects of radiation oncology?

Twitter, our study is the first in the literature to suggest that medical students share the same preoccupation as residents over a gloomy labor market. According to our data, job market concerns were what primarily worried students interested in RO and for those that matched RO in 2020.

Although the interplay of physics with the American Board of Radiology examinations has had its fair share of discussion, little is known about the medical student's perception of physics in RO. Our study revealed that among students who had not considered RO as a career, the major concern was applying physics to practice, with lack of proficiency and disinterest as frequently cited reasons. This fear is likely born out of minimal or no exposure to medical physics (most premed prerequisites include general physics) and unfamiliarity with the collaborative and supportive relationship between the medical physicist and radiation oncologist. An important point should be made that mastery of physics is not essential to pursue a career and succeed in RO. Of note, the distaste for physics was mostly expressed by women and could be a contributing factor to the gender disparity in RO.¹⁰ Similar observations regarding women and physics have been noted in radiology.¹¹ The etiology for underrepresentation of females in science, technology, engineering, and mathematics fields is not entirely clear but is often attributed to societal and environmental challenges such as structural education barriers and family influences.¹² Additional exploration regarding the effect of physics as an independent factor for the gender disparities in RO should be investigated.

Upon further analysis of students who were interested in RO but ultimately applied to a different specialty, about

a third were introduced to the field from the curriculum and a third from clinical rotations. For this cohort of potential RO applicants, the job market was the most salient concern and a potential disincentive for students interested in RO at one point. This was followed by concerns over the application of physics and United States Medical Licensing Examination scores (Table 3). Efforts to address the present-day apprehension of medical students considering a career in RO should be prioritized in this time of a declining applicant pool.

The expansion of RO programs is commonly thought to be a principal factor contributing to the imbalance between applicants and available residency positions. Beginning in 2005, the number of RO postgraduate-year 2 positions increased from 128 to 192 over the span of 14 years. Even with this substantial increase in residency positions, there were always more applicants than available spots until the 2018/2019 application cycle.³ Although the number of spots subsequently decreased to 175 in 2020 (from 192 in 2019), the US allopathic applicant pool experienced a greater relative decline of 21.5%.^{3,13}

We acknowledge there are several limitations to this study. Obtaining consent for survey distribution from medical schools was challenging, with survey fatigue frequently cited as a reason to decline participation. Furthermore, it was difficult to optimize response rates at the institution and student body level. The novel COVID-19 pandemic was acutely developing at the time of data collection, which hindered the distribution of surveys. Additionally, lack of direct e-mail contact with the student bodies or access to list servers (usually kept private by the institutions' deans' offices) resulted in a

Table 3 Subgroup analysis of students interested in RO

	n = 35 (%)
Gender	
Male	18 (51.4)
Female	17 (48.6)
Specialty applied to	
Anesthesiology	2 (5.7)
Dermatology	2 (5.7)
Family medicine	2 (5.7)
General surgery	1 (2.9)
Internal medicine	8 (22.9)
Neurology	2 (5.7)
OB/GYN	1 (2.9)
Ophthalmology	1 (2.9)
Orthopedic surgery	1 (2.9)
Pathology	1 (2.9)
Plastic surgery	1 (2.9)
Psychiatry	2 (5.7)
Radiation oncology	7 (20.0)
Radiology	4 (11.4)
Exposure to RO	
Yes, from medical school curriculum	11 (31.4)
Yes, from clinical rotation	11 (31.4)
No	13 (37.1)
General perception of RO	
Positive	23 (65.7)
Neutral	11 (31.4)
Negative	1 (2.9)
Positive aspects of RO	
Research	22 (62.9)
Lifestyle/resident workload	32 (91.4)
Level of physician burnout	19 (54.3)
Patient population	22 (62.9)
Focalized specialization	20 (57.1)
Size of field	6 (17.1)
Salary	32 (91.4)
Job market	4 (11.4)
Technology	26 (74.3)
Physics	14 (40.0)
Length of training	7 (20.0)
Other	0 (0.0)
Negative aspects of RO	
Research	6 (17.1)
Lifestyle/resident workload	0 (0.0)
Level of physician burnout	2 (5.7)
Patient population	3 (8.6)
Focalized specialization	7 (20.0)
Size of field	10 (28.6)
Salary	0 (0.0)
Job market	26 (74.3)
Technology	5 (14.3)
Physics	13 (37.1)
Applicant board scores	13 (37.1)
Length of training	5 (14.3)
Other	3 (8.6)

Abbreviations: OB/GYN = obstetrics and gynecology; RO = radiation oncology.

response rate that is lower than most benchmarks for survey studies.¹⁴ Although this may limit the generalizability of this study, this data set remains the best available information to date on the topic. Another factor to consider is the differential focus on specialization versus primary care at various medical schools, which may inherently sway students to hold certain opinions about a highly specialized field such as RO. It is difficult to generalize the perceptions of all medical students with data from a limited survey set; however, the students sampled in this study appropriately reflect the proportions of ethnic backgrounds and matched specialties observed nationally, with the exception that males are slightly underrepresented in this cohort. Taking into consideration the limitations of this study, we nonetheless believe the conclusions are meaningful, relevant, and informative at the present time.

In summary, our study suggests several important concepts and sheds light on the present-day concerns of medical students. Integration of RO into medical school curricula clearly remains a challenge. For students that gained exposure and considered a career in RO during medical school, concerns over the job market were salient. The majority of students were never exposed to RO and consequently did not explore it as a career option. Among this population, a knowledge gap may exist with misconceptions over the amount of physics knowledge required for success in RO practice. This could be responsible for the lack of interest and motivation to further explore the field in most medical students. Efforts to enhance the reputation of RO among students should focus on increasing exposure to RO and better defining the specific interplay between medical physics and the specialty. The message that mastery of physics is not imperative for RO should be communicated to medical students during the formative years of their education. In addition, concerns and misperceptions over the posttraining job market must be directly addressed to medical students, particularly those considering a career in RO.

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