

Scientific Article

Predictors of Interest in Radiation Oncology: The Effect of Race, Ethnicity, Gender, and Other Diversity Measures



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Abstract

Purpose: The presence of women and people underrepresented in medicine (URiM) continues to be lower in radiation oncology (RO) than within the United States population, medical school graduates, and oncology fellowship applicants. The objective of this study was to identify demographics of matriculating medical students who are inclined to consider pursuing a residency in RO and identify barriers to entry that students may perceive before medical school training.

Methods and Materials: A survey of incoming medical students at New York Medical College was distributed via e-mail and assessed demographic background information, interest in and awareness of oncologic subspecialties, and perceived barriers to RO.

Results: Students of the incoming class of 2026 had a complete response rate of 72% (155 complete responses and 8 incomplete responses of 214 class members). Two-thirds of participants had prior awareness of RO, and half have considered pursuing an oncologic subspecialty, but less than one-fourth have ever previously considered a career in RO. Students responded that they need more education, clinical exposure, and mentorship to increase their chance of choosing RO. Male participants had 3.4 times the odds of having an acquaintance in the community tell them about the specialty and also had significantly greater interest in using advanced technologies. There were no URiM participants who had personal relationships with an RO physician compared with 6 (4.5%) non-URiM participants. The average response to “What is the likelihood that you will pursue a career in RO?” showed no significant difference between genders.

Conclusions: All races and ethnicities scored a similar likelihood of pursuing a career in RO, which differs greatly from the current RO workforce. Responses emphasized the importance of education, mentorship, and exposure to RO. This study demonstrates the need for support of female and URiM students during medical school.

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Introduction

The diversity of the United States (US) population continues to increase, and there is known variability of incidence, prevalence, and disease presentation based on

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demographic factors such as race and ethnicity. Increased creative problem solving and broader perspectives are achieved with more diversity, and prior studies have found that having a shared race or ethnicity between the patient and provider is associated with improved overall health care outcomes as well as patient satisfaction and adherence to treatment recommendations.¹ Therefore, it is imperative to have diverse specialists in every medical field. Given the aging population of the US and overall increased prevalence of many cancer types, it is particularly important to increase the diversity of providers in the many oncologic subspecialties, including medical oncology, surgical oncology, and radiation oncology.

There continues to be disproportionately fewer women and people from racial and ethnic groups underrepresented in medicine (URiM) in radiation oncology (RO) than among the US population, medical school graduates, and medical oncology fellowship applicants.² Although the proportion of women in most medical specialties has increased over time, the percentage of women in RO has had a slow growth rate, ranking the lowest compared with 15 other specialties with an absolute change of 0.4% between 2016 and 2020.³ Over the past 30 years, the percentage of women among medical oncology fellows and faculty has increased by approximately 1% per year, while the percentage of women among RO physicians has increased by about 0.3% per year in that time.⁴ Additionally, in 2017, only 9% of academic RO department chairs were women.⁴ The increase in URiM representation in RO has lagged behind the increase in female representation.² Although the total number of RO residents more than doubled from 274 in 1974 to 720 in 2016, Black residents peaked at 31 of 522 in 1984 (5.9%) and dropped to 23 of 720 in 2016 (3.2%).⁵ In this same period, the number of Black medical students nearly doubled as well (3506-6905).⁵ This disproportionate representation indicates the strong need for an assessment of factors leading to specialty selection and retention.⁶

Almost 80% of medical schools graduated at least 1 radiation oncology resident in 2019; however, only 52% of schools graduated at least 1 female RO resident and 14% graduated a URiM RO resident.⁷ The lack of exposure to RO has been reported as one of the most common reasons for not pursuing the specialty, with 50% of medical student respondents indicating this as their reason.⁸ There are very few presentations given by department faculty targeted toward female or URiM students. For example, in 2021 only 15% of departments actively promoted the American Society for Radiation Oncology's (ASTRO) Minority Summer Fellowship to their general student body.⁶ The diversity of students who are members of ASTRO compared with resident members-in-training is also significantly different.⁶ In 2021, student members were 40% female and 10.7% Black or African American, and RO resident members-in-training were 31.5% female and 4.8% Black or African American.⁶

These statistics, in conjunction with the decreasing number of student applicants in RO, signals a need for further investigation into awareness of the field and perceived barriers to entry.⁸ Prior studies have been conducted on the knowledge, exposure, and interest of active medical students in RO. However, little is known about baseline knowledge and preconceptions of students about RO before starting their medical education. The demographics of these students may affect their values when choosing a specialty and their preconceptions about RO. The objective of this study was to identify populations of incoming medical students at New York Medical College School of Medicine (hereafter NYMC) who are inclined to consider pursuing a residency in RO. This study aims to identify the demographics and perspectives of incoming medical students pertaining to the field of RO.

Methods and Materials

A cross-sectional survey of matriculating medical students was conducted to assess interest in RO, awareness of the residency, and demographic background. This study was developed using a survey with a convergent mixed-methods design. Quantitative and qualitative responses from respondents were elicited through multiple choice, rating, and open-ended questions to further understand awareness and interest in RO.

The survey was created using Qualtrics. It consisted of 40 questions and required approximately 5 to 7 minutes to complete. Categories of questions consisted of demographics, awareness, and interest in oncologic subspecialties and Likert scale questions regarding medical career attributes. The demographic variables collected included: age, race, ethnicity, sex at birth, gender identity, country of birth, the region of the US in which the student attended high school (if the student was raised in the US), whether or not the student was a native English speaker, religion, whether or not they had a physician as a first-degree relative, whether or not they were the first person in the family to attend graduate school in the US, and whether or not they had a personal relationship with a radiation oncologist. Race and ethnicity questions were phrased in accordance with the US Census survey. Additional information collected included self-reports of awareness of the field of RO, consideration of pursuing a RO residency, and perceived barriers to entering the field of RO. The Likert scale ranged from 1 to 5, with 1 meaning "not likely at all" and 5 meaning "definitely," and statements consisted of the following: "I value taking time to think through problems with very few emergencies," "I value evidence-based decision making and an intellectual environment," "I want to work closely with a variety of other physicians," "I want to be more involved in treatment than diagnosis of medical conditions," "I want to use advanced technologies to treat patients," "I want to

spend a lot of time working with patients on a daily basis,” “I want to see my patients for long-term follow-up,” and “I am looking to become highly specialized rather than provide primary care.”

The study population consisted of the matriculating students of the class of 2026 at NYMC. The survey was disseminated to a total of 214 incoming students. Students responding as Black/African American, Hispanic, Native American, or Hawaiian/Alaskan native were considered URiM. Participation was encouraged through e-mails to the class distribution list and sessions during prematriculation and orientation. Students were incentivized to participate by being told that if total class participation reached 80%, 5 students would be randomly selected to win a gift card. Participants were able to access the survey through a link or a quick response (QR) code provided in the e-mail. The survey was available over a period of 3 weeks during the month of July before the start of medical school. Participation was voluntary and anonymous. A statement informing participants of the goals, length, and risks was shown before the start of the survey.

The survey data were collected and analyzed with Qualtrics and Microsoft Excel. Percentages were used for reporting survey responses, and odds ratios (ORs) and unpaired *t* test analyses were used for subgroup analyses. A *P* value <.05 was considered statistically significant. The study was approved by the NYMC institutional review board.

Results

Overall

A total of 163 of the 214 students in the incoming NYMC class of 2026 participated in the survey. Eight of these responses were incomplete and removed from analysis. One hundred fifty-five complete responses were collected, equating to a 72% complete response rate. Participants predominantly lived in the Northeast during high school (70%), and most participants were 18 to 24 years old (65%) (Table 1). Seventy-two respondents (46%) answered that their sex at birth was male and their gender identity is male/man, and 83 respondents (54%) answered their sex at birth was female and 82 (53%) stated that their gender identity is female/woman. One participant responded that their gender identity is nonbinary. There were no responses for intersex, transfemale, transmale, genderqueer, or other. Racial demographics indicated 102 (64.6%) White and 26 (16.5%) other Asian, followed by 8 (5.0%) Chinese, 5 (3.2%) Black/African American, and 9 (5.7%) other/not listed. Twenty-one participants (13%) were of Hispanic, Latino, or Spanish origin. Thirty-seven (24%) were not born in the US, and 25 (16%) answered that English was not their first language.

Table 1 Demographic characteristics of study participants (n = 155)

Location during high school	
Northeast	110
South	6
Midwest	5
West	12
Southwest	9
Outside of the US	13
Mid-Atlantic	3
Age (y)	
18-24	100
25-29	47
30+	8
Sex	
Male	72
Female	83
Gender	
Male	72
Female	82
Nonbinary	1
Race	
White	102
Black/African American	5
Asian	40
Other/not listed	9
Prefer not to answer	2
Ethnicity	
Non-Hispanic	134
Hispanic	21
Born in the US	
Yes	118
No	37
English as first language	
Yes	130
No	25
<i>Abbreviation: US = United States.</i>	

Demographics of participants closely matched the total class demographics (51% male, 49% female, 4% Black/African American, 24% Asian, and 12% Hispanic, Latino, or Spanish).

One hundred three (67%) participants stated that they have previously been aware of RO as a medical specialty. This was similar to the response of 106 (69%) for surgical oncology but lower than the response of 127 (82%) for

medical oncology. Seventy-nine (51%) students responded that they are considering pursuing a career in oncology, but only 32 (21%) have ever previously considered RO residency. Students responded that they became aware of RO through an acquaintance in the community (27 responses, 21%), a family member (23 responses, 18%), another medical student (12 responses, 9%), or an advisor/mentor (10 responses, 8%). The predominant response was “other” (43 responses, 33%), with open responses consisting of personal research into medical specialties, previous shadowing experiences, and media such as television and social media.

When asked about the likelihood of pursuing a career in RO on a 5-point Likert scale, the mean response was 2.44 with a standard deviation of 0.67, equating to between “probably not” and “maybe.” The most common response to why this likelihood was not higher was “I do not know enough about radiation oncology” (63%), followed by “I already know what specialty I want to pursue” (19%), “I do not like physics” (14%), and “I do not like oncology” (10%). Open responses to this question (9%) stated the following: limited patient interaction, still exploring all specialties, difficult job market, too much screentime, and too competitive of a field.

The concluding survey question asked “What would be necessary to increase the chance of choosing RO for residency?” and 33% of participants stated they needed more information and education about the field. An additional 23% requested exposure to the specialty through rotations or shadowing, and 7% asked to speak with a current radiation oncologist or mentor in the field. Other student responses referred to the selectivity and job competition of RO (5%) and length of residency (2%).

Gender

When asked if previously aware of RO, the OR of men compared with women was 1.63 (95% confidence interval

[CI], 0.83-3.2; $P = .16$), indicating higher male awareness but no statistically significant difference between genders (Fig. 1). Male participants had 3.4 times the odds of having an acquaintance in the community tell them about the specialty (95% CI, 1.4-8.2; $P = .008$). The average responses on a 5-point Likert scale to “What is the likelihood that you will pursue a career in RO?” were 2.49 for men and 2.40 for women ($P = .41$), indicating no significant difference between genders. When asked why the likelihood is not higher, 21% of women selected “I do not like physics” compared with only 5.6% of men, giving a 4.38 OR (95% CI, 1.4-13.7; $P = .011$). Genders were not significantly different in choosing any of the following: “I do not know enough about RO,” “I already know what specialty I want to pursue,” “It seems too challenging,” and “I do not like oncology” (Fig. 2).

Analysis of ratings showed a significant difference between men and women’s interest in using advanced technologies to treat patients. Men averaged a score of 4.51 and women 4.04. Unpaired t test results showed statistical significance with a difference in means of 0.47 (95% CI, 0.19-0.75; $P = .0012$). There were no significant findings among genders in rating the following: “I value taking time to think through problems,” “I value evidence-based decision making,” “I want to work closely with a variety of other physicians,” “I want to be more involved in treatment than diagnosis of medical conditions,” “I want to spend a lot of time working with patients on a daily basis,” “I want to see my patients for long-term follow-up,” and “I am looking to become highly specialized rather than provide primary care.”

Race and ethnicity

A total of 25 participants were identified as URiM. There was no significant difference in awareness of the field of RO between responses among URiM and non-URiM participants (OR, 1.5; 95% CI, 0.56-4.06; $P = .41$)

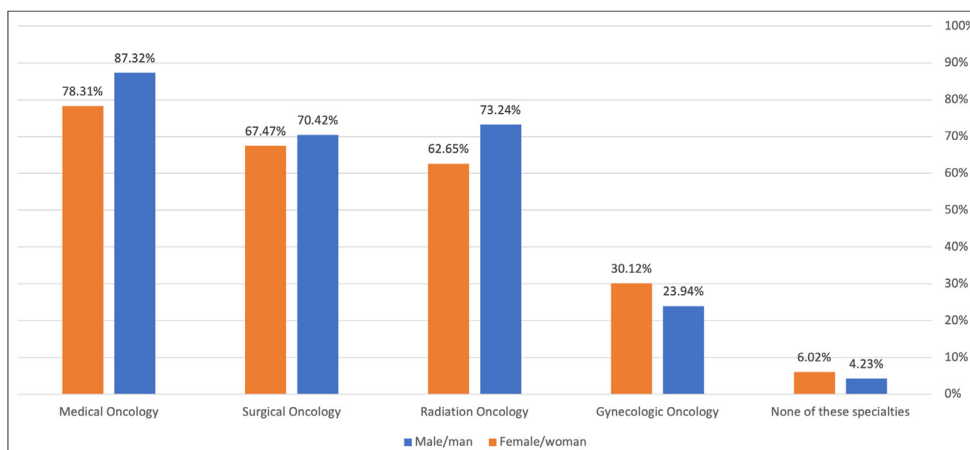


Figure 1 Awareness of oncologic subspecialties by gender.

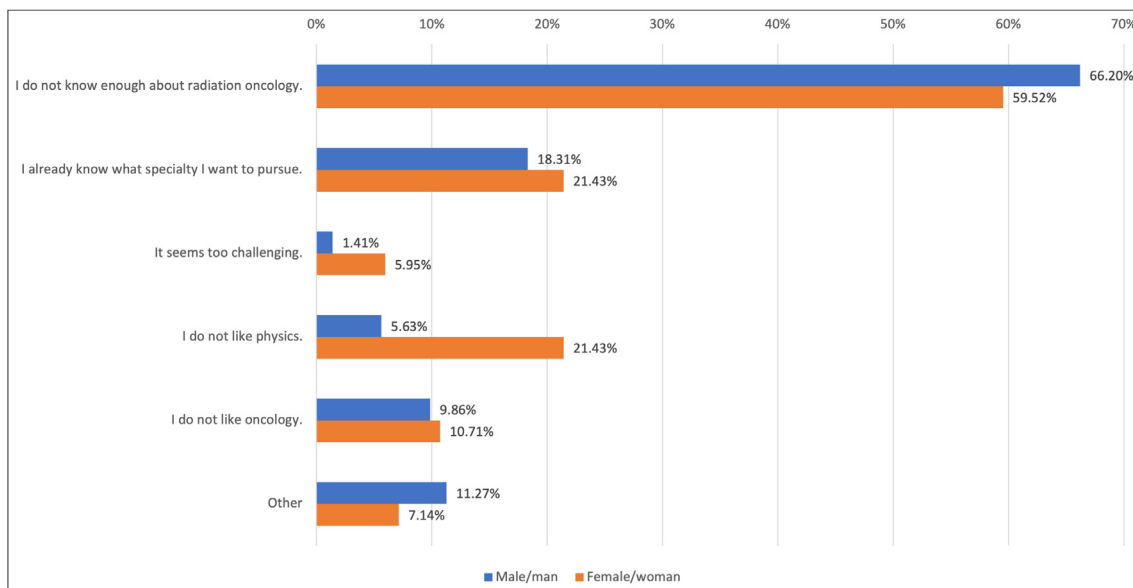


Figure 2 Reasons the likelihood of pursuing radiation oncology is not higher by gender.

(Fig. 3). Among the 19 URiM participants who were aware of RO, 4 (21.1%) were made aware through a family member and 6 (31.6%) through an acquaintance in the community, similar to 19 (17.6%) aware through a family member and 24 (22.2%) aware through an acquaintance among non-URiM participants (OR, 1.25; 95% CI, 0.37-4.19; $P = .72$ and OR, 1.60; 95% CI, 0.55-4.70; $P = .379$, respectively). The most common response to why the likelihood of pursuing RO was not higher was consistently “I do not know enough about RO” for both URiM and non-URiM (Fig. 4). In an analysis of Asian participants compared with non-Asian participants, there was no significant difference in awareness of the field of RO (OR,

1.41; 95% CI, 0.62-3.22; $P = .41$). There were no URiM participants (0%) who had a personal relationship with a radiation oncologist. This was compared with 6 non-URiM participants (4.5%), giving an OR of 0.38 (95% CI, 0.02-6.88), but this lacked statistical significance ($P = .51$) because of sample size.

Language, family, and personal connections

Participants whose first language was not English had no significant difference in responses compared with native English speakers regarding awareness of RO (OR,

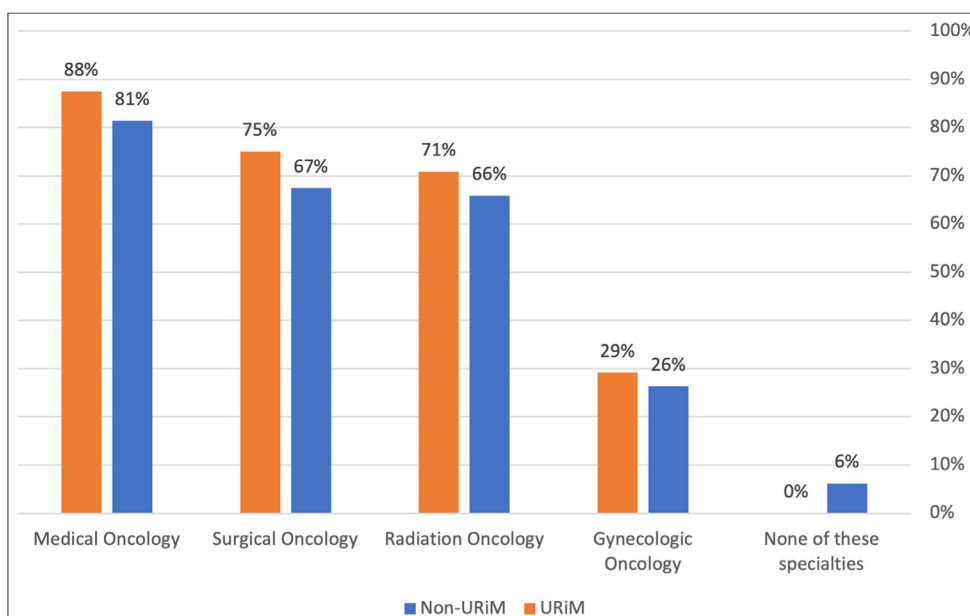


Figure 3 Underrepresented in medicine (URiM) versus non-URiM previous awareness of oncologic specialties.

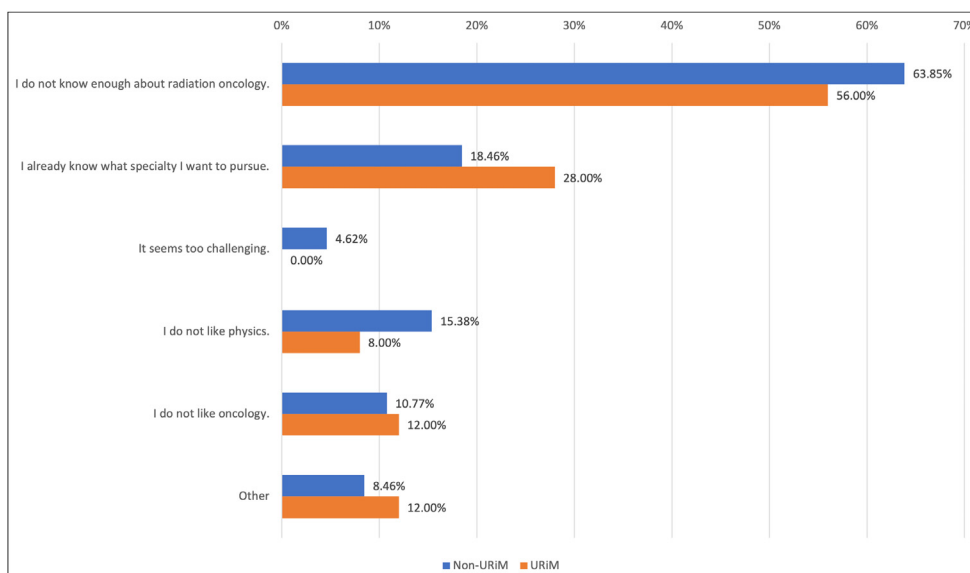


Figure 4 Underrepresented in medicine (URiM) versus non-URiM reasons the likelihood of pursuing radiation oncology is not higher.

0.69; 95% CI, 0.29-1.67; $P = .41$). There were no differences in likelihood of pursuing the specialty ($P = .74$). In response to “I am looking to become highly specialized rather than provide primary care,” participants whose first language was not English had a higher average rating of 4.20 compared with 4.08, but this did not show statistical significance ($P = .11$). Fifty-one (33%) participants responded that they have a first-degree relative who is a physician. Those with a first-degree relative who is a physician were 8 times more likely to be made aware of RO through a family member (OR, 8.1; 95% CI, 2.95-22.2; $P < .0001$). There was no significant difference, however, in the percent of participants with or without a physician relative who were previously aware of the specialty (OR, 1.71; 95% CI, 0.81-3.60; $P = .16$). Students with a first-degree relative with a graduate degree from the US had twice the odds of being aware of RO (OR, 2.0; 95% CI, 1.02-4.00; $P = .044$).

Discussion

Unlike the demographics of the current RO workforce, the demographics of students with a baseline interest in RO have not been thoroughly studied. Prior studies have identified the challenge of recruiting women and students who are URiM to the field of RO.²⁻⁴ Representation of women and URiM has grown at a rate slower than many other medical specialties.⁵ ASTRO medical student membership is disproportionately more representative of these populations than RO resident members-in-training.⁶ Further investigation regarding preconceptions, exposure to opportunities, and financial and systemic barriers is necessary to identify means to increase racial and ethnic diversity and reduce the gender imbalance in RO.

Minimal research has been conducted previously on medical student interest in and exposure to RO before beginning training and what factors before medical school may influence these discrepancies between medical student and RO resident population demographics. The current study therefore provides important new insights as to perceptions and interest in RO through a survey of medical students prematriculation.

When interviewed about diversity and inclusion, RO department chairs stated that deliberate and proactive recruitment efforts are needed, and it would be best to engage with students before their applications to medical school.⁹ Results from this survey corroborate the opinions of these department chairs, with students asking for more information and exposure before or during medical school. Students repeatedly responded to survey questions by stating that they would consider the field if they had “more understanding of the field” and “more experience.” One participant stated “I would need to learn more and be exposed to the field, then evaluate if it is appropriate for me.” The students participating in the survey displayed very little disinterest or opposition to the field of RO, but rather expressed a lack of knowledge and awareness of the field.

Results from this survey showed that before medical education, race and ethnicity had no significant association with interest in pursuit of residency in oncology or specifically in RO. This indicates a need for further data collection and study of students before and during medical school to strengthen this finding and identify when the racial, ethnic, and gender disparity in interest in pursuing RO residency training occurs.

The small sample sizes of racial and ethnic groups created limitations in data analysis of these subpopulations. The survey had a strong response rate of over 70% of the

incoming medical student class, with a similar proportion of URiM responses as in the class (16.1% URiM participants and 18% URiM students in incoming class). The incoming class percentage of students identifying as URiM was similar to that of the Associated Medical Schools of New York, which reported for 2020 to 2021 enrollment 21.1% of students identifying as URiM. However, the small sample number of URiM participants ($n = 25$) resulted in limited strength of statistical tests. It would be beneficial to conduct future surveys among a larger URiM population, for example by including multiple sites, when studying the interest of students and their barriers to entry in the field of RO. Future studies should be conducted to expand upon these survey findings and identify additional URiM-specific concerns and opinions regarding RO over the subsequent course of medical education. A possible next step might be to survey students at all medical schools in New York state or even nationwide to increase the power of the study to detect differences based on race and ethnicity. Surveying of student groups, such as the Student National Medical Association, the Latino Medical Student Association, Asian Pacific American Medical Student Association, or the American Medical Women's Association may also be beneficial to identify values and interests within these populations.

Predictive factors of female student interest in specialties have previously been identified as number of years of training required, amount of work hours, and baseline number of female physicians, as well as the presence of role models in the field who are women.³ In regard to RO, there were significant differences between women and men in survey responses when it came to being informed of the field by a second party and interest in physics and new technologies, all of which were higher for male versus female respondents.

On the whole, desire for role models and connections with leaders in RO were displayed through many open-ended responses stating that mentorship would increase the likelihood of pursuit of RO. Promotion of programs such as free ASTRO membership for medical students, ASTRO Mentor Match, and the ASTRO Minority Summer Fellowship is critical to pair medical students with radiation oncologists early in their education and training to increase awareness of RO before their decision for residency is made. Focus on outreach and mentorship to women and URiM medical students regarding these and similar programs may help in diversification of the RO workforce.

Conclusion

The representation of female and URiM residents and physicians in RO lags behind many other specialties, and its growth requires attention. Matriculating students showed little to no difference in consideration of pursuing a career in RO across races or ethnicities, which differs

from the current RO workforce. Students repeatedly expressed the need for increased education, exposure, and mentorship to select RO for residency. Although there were variations in responses regarding interests and barriers among matriculating medical students, the overwhelming response from students was a lack of awareness of the field of RO. This study highlights the importance of targeted outreach and education for premedical students and incoming medical students to diversify the future RO workforce. The survey responses emphasize the importance of opportunities within RO throughout medical school to retain interest among students who are female or URiM. Future surveys of students across their 4 years of medical school education would be beneficial in identifying causes of dissuasion or hesitation of pursuing a career in RO before applying to residency. Additional broader studies encompassing many medical schools would increase power and allow for better detection of differences among subpopulations.

Supplementary materials

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.adro.2022.101140](https://doi.org/10.1016/j.adro.2022.101140).

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