

Scientific Article

Demographics of ASTRO Student Members and Potential Implications for Future U.S. Radiation Oncology Workforce Diversity



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Received August 26, 2021; revised September 6, 2021; accepted September 28, 2021

ABSTRACT

Purpose: The radiation oncology workforce in the United States is comparatively less diverse than the U.S. population and U.S. medical school graduates. Workforce diversity correlates with higher quality care and outcomes. The purpose of this study was to determine whether student members of the American Society for Radiation Oncology (ASTRO) are any more diverse than resident members-in-training using the recently established medical student membership category.

Methods and Materials: Self-reported sex, race and Hispanic ethnicity, medical school, and degree(s) earned for all medical students (n = 268) and members-in-training (n = 713) were collected from the ASTRO membership database. International members were excluded. The χ^2 test was used to assess for differences between subgroups.

Sources of support: This work had no specific funding.

Disclosures: The authors report no conflicts of interest related to the submitted work.

Research data are not available at this time.

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<https://doi.org/10.1016/j.adro.2021.100834>

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Results: Compared with members-in-training, student members were more likely to be female (40.0% vs 31.5%, $P = .032$), black or African American (10.7% vs 4.8%, $P = .009$), candidates for or holders of a DO rather than MD degree (5.2% vs 1.5%, $P = .002$), and from a U.S. medical school that is not affiliated with a radiation oncology residency program (30.5% vs 20.9%, $P = .001$). There was no significant difference in self-reported Hispanic ethnicity (7.3% vs 5.4%, $P = .356$). There were no indigenous members in either category assessed.

Conclusions: Medical student members of ASTRO are more diverse in terms of black race, female sex, and osteopathic training, though not in terms of Hispanic ethnicity or nonmultiracial indigenous background, than the members-in-training. Longitudinal engagement with these students and assessment of the factors leading to specialty retention versus attrition may increase diversity, equity, and inclusion in radiation oncology.

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Introduction

Health disparities, in which a higher burden of illness, injury, disability, or mortality is experienced by 1 group relative to another are a manifestation of the chronic inequalities present in U.S. society.^{1,2} In oncology, U.S. patients from racial and ethnic minority groups tend to experience worse cancer outcomes compared with white individuals, but fundamental changes to reduce these disparities remain elusive.³

Increasing physician workforce diversity has been identified as a means to improve health equity, and overcome societal biases and inequities such as racism and sexism that lead to the exclusion and/or disproportionate underrepresentation of certain demographic groups in the United States.⁴ Physicians from racial and ethnic groups that are historically underrepresented in medicine (UIM) are more likely to practice in medically underserved communities and conduct health disparities research.⁵⁻⁸ Patients managed by a physician from the same background are more likely to be satisfied with their ability to communicate with their provider and the treatment they receive, with evidence demonstrating improved outcomes and survival as well.^{9,10} Medical students from medical schools with greater racial and ethnic diversity report improved cultural awareness, competence, and humility.¹¹

Medical school graduates have become increasingly diverse over time, but this has not been proportionately reflected in all specialties. Radiation oncology ranks in the lower third of representation among 33 medical specialties, according to data from the Association of Medical Colleges (AAMC), with a workforce comprised of 3.3% black physicians, 3.4% Hispanic physicians, and 27.2% female physicians.¹² Furthermore, in U.S. radiation oncology training programs and the overall radiation oncology physician workforce, racial, ethnic, and sexual diversity has been relatively static over the past few decades, and in the case of black radiation oncologists has worsened.^{13,14}

A critical aspect of addressing this issue is understanding when and why medical students are choosing other specialties instead of radiation oncology. Many medical students have little to no exposure to radiation

oncology,¹⁵⁻¹⁷ particularly at schools with a smaller affiliated radiation oncology department, which is more common at medical schools that educate a higher proportion of underrepresented students in the United States.^{14,18} However, even for those students exposed to radiation oncology, a number of additional barriers may still contribute toward systemic exclusion from the field.¹³ Little is known about the population of medical students who have an interest in radiation oncology but ultimately either choose to pursue another specialty or do not match into radiation oncology.

In December 2017, the American Society for Radiation Oncology (ASTRO) introduced a student membership category with free membership, affording a novel opportunity to engage interested students. The purpose of this study was to compare the demographics of the ASTRO medical student members to the demographics of radiation oncology resident members.

Methods and Materials

Data source

In December 2020, ASTRO staff compiled a deidentified list of all individuals in the “member-in-training” ($n = 755$) and “student/graduate student/postgraduate year (PGY)-1” ($n = 382$) membership categories. U.S. and international residents who are in an accredited radiation oncology program (PGY-2 through PGY-5) are eligible for ASTRO member-in-training membership. U.S. and international medical students enrolled full-time in an accredited school of medicine, graduate students enrolled in a doctoral program, and PGY-1 residents are eligible for ASTRO student/graduate student/PGY-1 membership. For the purposes of this analysis, all students currently at international medical schools and members-in-training currently in international residency programs were excluded. Additionally, students who reported having an anticipated degree other than a MD or DO and identified their current institution as a company, cancer center, or radiation oncology department, rather than a medical school, were excluded because these individuals

were likely on a nonphysician track. The student database is routinely updated by ASTRO staff on a yearly basis by contacting all student members to ask if they are still interested in radiation oncology, and those who are not are removed from the membership database.

Data variables

Demographic information collected from the ASTRO database for all members included self-reported sex, race/ethnicity, medical school, and degree(s) earned in the case of members-in-training or anticipated in the case of students. Sex was collected as binary male and female. ASTRO collects "race/ethnicity" as a single entity with 6 available options (Asian, black or African American, Hispanic, Native American or Alaska Native, Native Hawaiian or Pacific Islander, and white or Caucasian), among which a member can select more than one option. For this analysis, race and ethnicity are reported separately. UIM is defined by the AAMC as those racial and ethnic populations that are underrepresented in the medical profession relative to their numbers in the general population.¹⁹ This definition does not specifically list which racial and ethnic groups are included, to accommodate changing demographics of society and the medical profession over time. Based on the available data in the ASTRO database, an individual was considered UIM if they self-reported as black or African American, Hispanic, Native American or Alaska Native, or Native Hawaiian or Pacific Islander. Non-Hispanic white and Asian individuals were not considered UIM for this analysis. Demographic subgroups with fewer than 5 individuals are not reported to preserve anonymity. Notably, ASTRO members are not required to provide any demographic information, and therefore not all demographic information was available for all members. Additionally, each medical school was scored for presence of an affiliated radiation oncology residency program (yes or no), ranking in 2020 National Institute of Health research funding (top 40 or not),²⁰ affiliation with a National Cancer Institute designated cancer center (yes or no),²¹ and geographic region of the medical schools using U.S. census definitions (northeast, midwest, south, or west).

Statistical analysis

The χ^2 test was used to assess for differences in each of these variables for student members compared with members-in-training. The percentages of UIM and female students and members-in-training within the ASTRO database were compared with the percentages of UIM and female students in all U.S. medical schools per AAMC data¹² and in all residency programs per Accreditation Council for Graduate Medical Education

(ACGME) data, respectively.²² *P* values less than .05 were considered statistically significant. Statistical analysis was performed using SPSS statistics version 27.

Results

A total of 713 members-in-training and 268 students met eligibility criteria for this analysis. The members-in-training approximate 96.6% of the 738 reported radiation oncology residents in the ACGME database.²² Median ages were 25 years old (interquartile range, 21-28) for students and 31 years old (interquartile range, 29-34) for members-in-training. Self-reported race/ethnicity and sex were available in 510 (72%) and 502 (71%) of the 713 members-in-training, respectively, and 191 (71%) and 195 (73%) of the 268 students, respectively. Demographic features of these groups are shown in Table 1. Relative to members-in-training, student members were more likely to be female (40.0% vs 31.5%, *P* = .032), black or African American (10.7% vs 4.8%, *P* = .009), candidates for or holders of a DO rather than MD degree (5.2% vs 1.5%, *P* = .002), and from a U.S. medical school not affiliated with a radiation oncology residency program (30.5% vs 20.9%, *P* = .001). There was no significant difference in Hispanic ethnicity (7.3% vs 5.4%, *P* = .356). A total of 20 of 713 members-in-training (2.8%) and 14 of 268 students (5.2%) selected multiple categories for race/ethnicity, most of which self-identified as Hispanic white (*n* = 14) or non-Hispanic white and Asian (*n* = 13). There were fewer than 5 American Indian, Alaska Native, Native Hawaiian, and/or other Pacific Islander members in the member-in-training categories; each also identified as white and are reported in the multiracial category. None of these indigenous groups were represented as student members.

A comparison of the demographics of current ASTRO members-in-training and students to that of all U.S. residents per ACGME data and U.S. medical students per AAMC data, is shown in Figure 1. Female representation among ASTRO members-in-training (32%) was significantly lower than among ASTRO student members (40%, *P* = .032), U.S. resident physicians (46%, *P* < .001), and U.S. medical students (48%, *P* < .001). Representation of UIM individuals among ASTRO members-in-training (11%) was significantly lower than among ASTRO student members (16%, *P* = .019), U.S. resident physicians (14%, *P* < .001), and U.S. medical students (14%, *P* < .001).

Discussion

Increasing workforce diversity leads to higher quality care and outcomes,^{9,10} particularly in the context of meeting the needs of underserved communities, addressing

Table 1 Demographics of members-in training and student members of ASTRO

	Members-in-training	Student members	P value
Sex			
Male	344 (68.5%)	117 (60.0%)	.032
Female	158 (31.5%)	78 (40.0%)	
Race			
White or Caucasian	303 (62.6%)	92 (51.7%)	.009
Asian	147 (30.4%)	60 (33.7%)	
Black or African American	23 (4.8%)	19 (10.7%)	
Native American or Alaska Native	0 (0%)	0 (0%)	
Native Hawaiian or Pacific Islander	0 (0%)	0 (0%)	
Multiracial	11 (2.3%)	7 (3.9%)	
Ethnicity			
Hispanic	26 (5.4%)	13 (7.3%)	.356
Non-Hispanic	456 (94.6%)	165 (92.7%)	
UIM			
Yes	53 (11.0%)	33 (15.6%)	.019
No	431 (89.0%)	178 (84.4%)	
Medical degree earned or offered at listed medical school			
MD	700 (98.5%)	254 (94.8%)	.002
DO	11 (1.5%)	14 (5.2%)	
US medical school has affiliated radiation oncology residency			
Yes	485 (79.1%)	186 (69.4%)	.001
No	128 (20.9%)	82 (30.5%)	
US medical school in top 40 for NIH Research funding			
Yes	263 (42.9%)	119 (44.4%)	.495
No	350 (47.1%)	149 (55.6%)	
US medical school with affiliated NCI cancer center			
Yes	357 (58.2%)	161 (60.1%)	.086
No	256 (41.8%)	107 (39.9%)	
US medical school region of all members			
Northeast	198 (32.3%)	77 (28.7%)	.583
Midwest	153 (25.0%)	86 (32.1%)	
South	196 (31.9%)	71 (26.5%)	
West	66 (10.7%)	34 (12.7%)	
US medical school region of UIM Members			
Northeast	16 (41.0%)	7 (21.9%)	.173
Midwest	12 (30.8%)	11 (34.4%)	
South	9 (23.1%)	8 (25.0%)	
West	2 (5.1%)	6 (18.8%)	

Abbreviations: ASTRO = American Society for Radiation Oncology; NCI = National Cancer Institute; NIH = National Institute of Health; UIM = underrepresented in medicine.

health disparities in the United States, and mitigating historical biases and inequities that lead to the exclusion of certain demographic groups.⁴⁻⁸ The past several decades have witnessed an increase in representation of female and UIM students in U.S. medical schools and graduate medical education overall.^{12,23} These increases are not mirrored in radiation oncology residency programs.¹⁴ Although prior studies have described the attrition in diversity that occurs from the time of the Electronic Residency Application Services application forward,^{14,23} our findings are novel in the characterization of medical students with an interest in radiation oncology based on registration in ASTRO, before their decision on whether to pursue a career in the specialty specifically at the

Electronic Residency Application Services step. This initial analysis of the ASTRO student membership category suggests that the pool of medical students with enough interest in radiation oncology to pursue ASTRO membership is more diverse in terms of sex, race, type of medical degree, and medical school attended than its radiation oncology resident members-in-training. Further longitudinal assessment of the students is needed to evaluate if, when, and how previously identified multifactorial barriers and deterrents related to exposure/access to radiation oncology, mentorship and sponsorship, and interpersonal and systemic bias may manifest along their course and lead to attrition or retention.¹³ Though student demographics do not necessarily reflect that of future

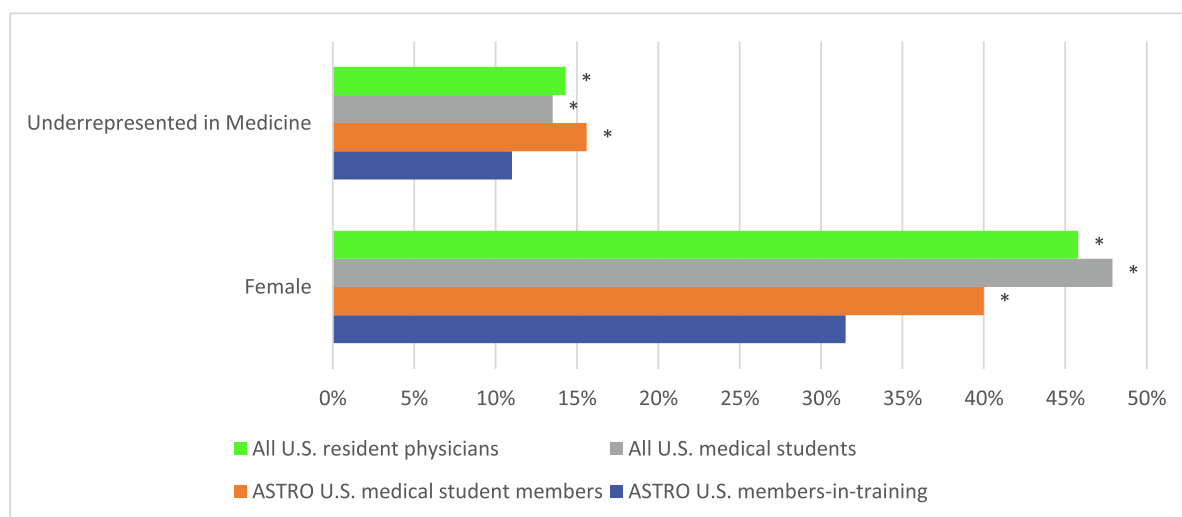


Fig. 1 Comparison of the demographics of current (2020) American Society for Radiation Oncology members-in-training (blue) and students (orange) to that of all matriculating US medical students (gray) and all US medical residents (green) for underrepresented in medicine (UIM) and female students. Asterisks denote a statistically significant difference compared with American Society for Radiation Oncology US members-in-training. *Abbreviations:* ASTRO, American Society for Radiation Oncology.

residents, if the interest of these students who are signing up for ASTRO membership can continue to be cultivated while addressing barriers and deterrents to training, there is potential that the radiation oncology workforce may be more diverse in the years to come.

The representation of medical student members of ASTRO is encouraging in relation to prior studies on workforce diversity. The 10.5% of the ASTRO student cohort comprised of black medical students is similar to the representation of black trainees in obstetrics and gynecology, which is the most commonly chosen field by black physicians, and close to the U.S. population representation at 12%.¹² This higher proportion of black medical students interested in radiation oncology is particularly encouraging given recent analysis showing that the number of black residents in radiation oncology is currently less than it was in the 1980s and 1990s.¹³ Although there has been a technical nonzero increase in the percentage of Hispanic radiation oncology residents (0.085% per year) in recent decades,¹³ this was not meaningfully reflected in a significantly higher percentage of Hispanic ASTRO student members than members-in-training, reflecting the potential need for greater outreach to Hispanic students, particularly as they represent 18% of the U.S. population, 6.7% of medical students, and 3.4% of all radiation oncologists.¹² Notably, the small number of indigenous populations in both student and member-in-training ASTRO cohorts also suggests an area of further efforts and growth, given that these groups represent 0.4% of physicians nationally.¹² At this proportion these groups should have represented greater than 1 medical student and greater than 2 to 3 members in training, which was not the case.

The 40% of the ASTRO student cohort comprised of women is also promising considering that according to a recent report, women represented only a one-quarter to one-third of radiation oncology trainees over the past decade, with a slower upward trend in representation of 0.3% per year compared with 1.0%/y for medical oncology.²⁴ Strategies to promote recruitment and retention of female faculty may help support the retention of these female medical students with an interest in the specialty.^{25,26} The discrepancies in medical school attended by students and members-in-training may suggest variability in the support and access to resources that students receive at different schools in different parts of the country. Finally, the proportion of members-in-training with an osteopathic degree is similar to the 1% to 2% range reported for U.S. resident physicians over the last decade.²² However, the percentage of U.S. residents in all graduate medical education programs with a DO degree has increased from 9% in 2015 to 16% in 2020.²² The higher DO representation among student members may reflect this trend throughout osteopathic medicine or a higher likelihood among DO students to use ASTRO to gain exposure that is lacking at their home institution.

ASTRO and its membership body has taken several steps to promote diversity, equity, and inclusion, through the work of the Committee on Health Equity, Diversity & Inclusion and programming to support leadership development (Leadership Pipeline Program) and premedical and medical student engagement (Aspiring Scientist and Physician Program and Minority Summer Fellowship [MSF] program). The MSF program, for example, currently provides summer research and mentorship

opportunities to 4 UIM medical students yearly, with most of these students ultimately applying for and matching in radiation oncology.²⁷

As a path forward, now that ASTRO offers free membership to medical students, it can and should expand engagement with this cohort of student members.²⁸ Creation of more formal targeted programming and coordination of education, research, and mentorship pathways for medical students are important steps to promote student awareness and professional development, expanding upon what has previously only been available to a limited extent to the few students who participate in the MSF and Aspiring Scientist and Physician Program. The Association of Residents in Radiation Oncology and its newly formed Equity & Inclusion Subcommittee recently launched a mentorship program geared toward UIM students, which can also be leveraged. As workforce diversification efforts expand, periodic review of the ASTRO student membership demographics for ongoing assessment and adaptation, as appropriate, of diversity-, equity-, and inclusion-oriented interventions would be valuable. Finally, in the current climate of the radiation oncology match,²⁹⁻³¹ where fewer students are interested in pursuing radiation oncology, it is particularly important that all radiation oncologists who interact with any medical students are prepared to provide objective, informed, and transparent advice to students still deciding on a career path and support those with an interest in pursuing radiation oncology.

There are several limitations to this study. First, not all medical students with interest in radiation oncology and radiation oncology residents are ASTRO members, and additionally not all members reported their demographic information. For instance, nearly 30% of members-in-training and student members did not report their race and sex. Despite this, we believe that our findings are still representative and informative given that the member-in-training data are similar to available ACGME data in terms of sex, race, and ethnicity.²² Furthermore, the student membership category included other types of students besides medical students, and because the data obtained from ASTRO were deidentified, exclusion criteria based on degree and affiliation had to be applied to indirectly restrict the analysis to medical students; ultimately, some nonmedical students (eg, therapy students or graduate students) may have been inadvertently included, and some active medical students inadvertently excluded. Additionally, it was not possible to exclude PGY-1 residents who already matched into radiation oncology from the student category, which is a potential confounding factor in the analysis. Recommendations provided to ASTRO include asking students for more explicit information regarding type of study, pursued degree, and medical school. Another important consideration is that this study reports only 1 point in time. Periodic review of membership data may provide validation

and trend analysis and help to demonstrate the effectiveness of specific initiatives geared toward improving diversity in radiation oncology residency programs. Additionally, student data do not reflect future residents, because not all may apply for, or match in, radiation oncology. Further study on the long-term outcomes of this cohort and the factors related to their future training and career path is needed. Finally, whether these findings are a result of increasing emphasis on diversity, equity, and inclusion from individual institutions or larger organizations like ASTRO, shifting specialty interest across demographics, or some combination therein cannot be determined.²⁹⁻³²

Conclusions

Medical student members of ASTRO are more diverse in terms of black race, female sex, and osteopathic training, though not in terms of Hispanic ethnicity or indigenous background, than the members-in-training. Longitudinal engagement with these students and assessment of the factors leading to specialty retention versus attrition may improve long-term diversity, equity, and inclusion in radiation oncology, to make the specialty more reflective of society and the patient population that it serves.

Acknowledgments

Support from ASTRO was provided by Anna Arnone and Todd Karstaedt.

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