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Medical Student Engagement in Radiation Oncology: Insights From a Residency Program Survey

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Abstract

Purpose: Medical student engagement (MSE) is critical to addressing the radiation oncology (RO) literacy gap among future physicians and may contribute to workforce stabilization amid fewer residency applicants compared to historic numbers. Currently, there is no standardized approach to MSE within RO. This study sought to characterize current MSE practices among U.S. RO residency programs, identify opportunities for collaboration, and inform development of best practices to strengthen MSE and interest in the specialty.

Methods and materials: An investigator-developed survey assessing MSE practices was distributed electronically to U.S. RO residency programs through the Association of Directors of Radiation Oncology Programs (ADROP) newsletter in March and April 2026. Survey domains included program characteristics, organizational commitment to MSE, outreach and recruitment activities, mentorship infrastructure, research accessibility, perceived effectiveness of engagement initiatives, and future needs for centralized support. Responses were analyzed descriptively using frequencies and percentages.

Results: Thirty-four of 86 U.S. RO residency programs responded (38.6%), with 31 surveys completed in full; the number of responses per question therefore varied. Nearly all programs (94.1%, n=32/34) reported conducting MSE activities, and 87.1% (n=27/31) believed MSE should be a formal strategic priority. Common engagement activities included clinical rotations (91.2%, n=31/34), research opportunities (91.2%, n=31/34), shadowing experiences (88.2%, n=30/34), program-led lectures (52.9%, n=18/34), and preclinical observerships (50.0%, n=17). Only 20.6% (n=7/34) of programs reported RO education as a required component of their affiliated medical school curriculum. Formal mentorship programs were reported by 41.9% (n=13/31) of programs, while 58.1% (n=18/31) relied on informal mentorship. Research mentorship was the most common mentorship activity (85.3%, n=29/34). Most respondents reported satisfaction with their MSE efforts (74.2%, n=23/31, satisfied or very satisfied). Frequently reported benefits included increased medical student rotators, improved student knowledge of RO, increased residency applicants, improved match outcomes, and enhanced applicant diversity. Most respondents (96.8%, n=30/31) indicated that centralized support resources would be useful or potentially useful.

Conclusions: RO residency programs demonstrate strong commitment to MSE through diverse educational, mentorship, and recruitment initiatives. However, substantial variability exists across programs. Greater program collaboration and centralized resources may enhance MSE efforts, improve student knowledge and awareness of RO, and strengthen future recruitment into the specialty.

Categories: Medical Education, Radiation Oncology
Keywords: choice of career, medical education, medical student engagement, radiation oncology education, workforce development

Introduction

Medical student engagement (MSE) initiatives are critical to addressing the radiation oncology (RO) literacy gap within the future physician workforce, as well as driving interest in the field to create a stable specialty workforce. Traditionally, medical schools largely omit dedicated RO education from the formal curriculum since there is not a requirement for curriculum inclusion per the Liaison Committee on Medical Education, nor is RO content included in the United States Medical Licensing Examination [1-4]. Oncology concepts are typically incorporated longitudinally within organ system- or disease-specific blocks and are rarely taught as stand-alone topics. When oncology is included in undergraduate medical education, instruction often emphasizes cancer biology, pathophysiology, and surgical or systemic treatment approaches, while core RO concepts receive comparatively little attention. As a result, many medical students graduate with limited understanding of the role of radiotherapy in cancer care [5,6]. In a prior survey, 96% of medical students recognized that RO is an essential component of oncology care, yet 62% reported that RO topics were

underrepresented in their medical school curriculum [7]. Limited exposure to RO may contribute to misconceptions regarding the indications, benefits, and toxicities of radiotherapy, potentially affecting future referral patterns and multidisciplinary cancer care [3,8].

MSE may also play an important role in supporting the future RO workforce. Since 2017, the number of applicants to RO residency programs has declined compared to historical numbers, contributing to increased rates of unfilled residency positions during the 2021-2023 Match cycles [9,10]. However, the ratio of applicants to available RO residency positions remained relatively stable with only a small increase in numbers from 2020 to 2025, suggesting that the subsequent decline in unfilled positions after the 2022-2023 Match cycle may reflect factors beyond an increase in applicant volume, such as changes in interview practices, applicant distribution, or applicant and program ranking preferences [10]. Although multiple factors likely influence specialty selection, limited exposure to RO during medical school represents a potentially modifiable barrier. Early engagement initiatives may increase awareness of the specialty, provide meaningful mentorship opportunities, and encourage talented students to consider careers in RO who may not otherwise have been exposed to the field [10-20]. However, little is known about how U.S. RO residency programs currently structure MSE efforts, including outreach activities, mentorship opportunities, and institutional support for these initiatives.

Despite the recognized importance of MSE, there is currently no coordinated or standardized approach to MSE within RO. Consequently, responsibility for MSE largely rests with individual residency programs and their leadership, resulting in substantial variability in outreach activities, mentorship opportunities, educational programming, and recruitment efforts. Understanding how residency programs currently approach MSE is an important first step toward identifying successful strategies and opportunities for collaboration. Therefore, this study sought to characterize current MSE practices among U.S. RO residency programs, identify opportunities for collaboration and centralized support, and inform the development of best practices to strengthen student engagement and interest in the specialty.

Materials And Methods

The study was conducted through Mayo Clinic Arizona. This was reviewed by the Institutional Review Board at Mayo Clinic Arizona and deemed to be exempt (25-006676). Participation was voluntary, and informed consent was implied through survey completion and submission. Participants were informed of the study purpose, the voluntary nature of participation, and their ability to discontinue the survey at any time without penalty.

The survey tool assessing MSE by RO residency programs was developed by the authors; a validated survey tool assessing RO residency program MSE efforts does not exist. The survey tool assessed primary domains including program characteristics and institutional context, organizational commitment to MSE, medical student outreach and recruitment activities, mentorship infrastructure and opportunities, research accessibility and educational opportunities, perceived effectiveness and outcomes of engagement initiatives, future needs, and centralized support. The full survey tool is available in the Appendices.

The survey was distributed electronically to RO resident programs through the Association of Directors of Radiation Oncology Programs (ADROP) newsletter distribution list as a separate link with the distribution of March and April 2026 newsletters. One response was requested per residency program. Survey completion could be done by a program director, associate program director, clerkship director, program coordinator, or other designated representative.

Survey responses were collected and analyzed descriptively. Categorical variables were summarized using frequencies and percentages. Percentages were calculated based on available responses for each survey item. Free-text responses were reviewed and grouped into common themes to characterize perceived successes, challenges, and future priorities related to MSE initiatives. Formal qualitative coding was not performed. Because not all respondents completed every survey item, denominators may vary across analyses.

Results

A total of 34 out of 86 RO residency programs in the United States responded to the survey, of which 31 (91.2%) completed the survey in its entirety (Figure *1*). Responding programs represented all major geographic regions of the United States, including the East North Central (n=9, 26.5%), Mid-Atlantic (n=7, 20.6%), West North Central (n=4, 11.8%), Pacific (n=4, 11.8%), East South Central (n=4, 11.8%), West South Central (n=2, 5.9%), South Atlantic (n=1, 2.9%), Mountain (n=1, 2.9%), and New England (n=1, 2.9%) regions. Most respondents were affiliated with academic training programs, including 17 (50.0%) multi-site academic programs and 16 (47.1%) single-site academic programs. One respondent (2.9%) represented a hybrid training model with substantial community-based rotations. Most RO residency programs were affiliated with a medical school (n=31, 91.2%). Program size varied, with 13 (38.2%) reporting 0-6 residents, 15 (44.1%) reporting 7-12 residents, and six (17.6%) reporting more than 12 residents.

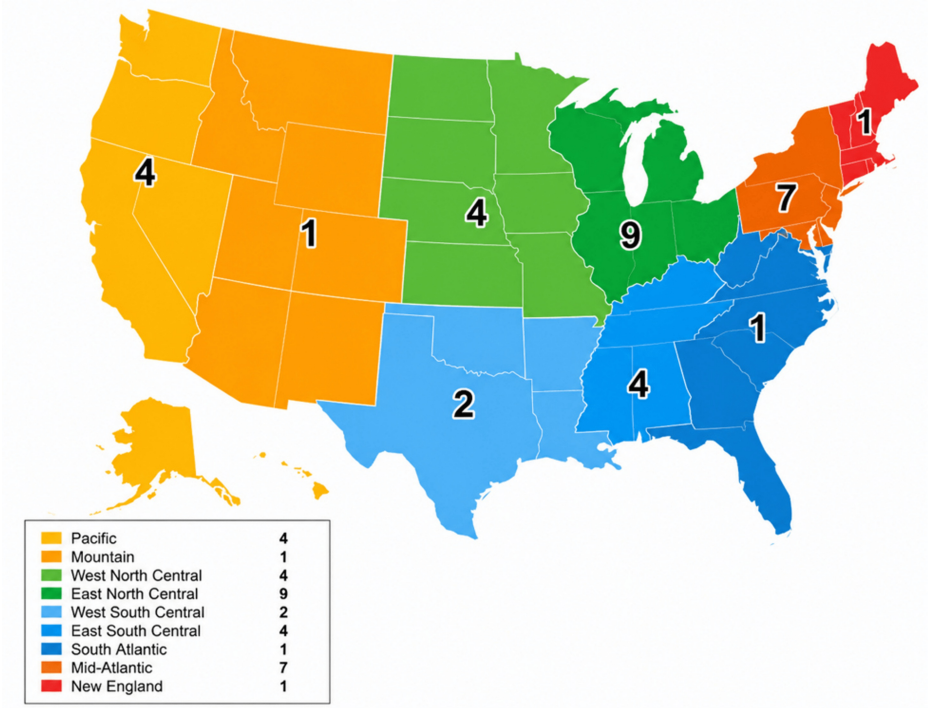


FIGURE 1: Geographic distribution of survey responses among U.S. radiation oncology residency programs by U.S. census region.

The figure was created with the assistance of Perplexity (Perplexity AI, Inc., San Francisco, CA, USA). The authors hold responsibility for the figure and have reviewed and checked the content.

Organizational commitment to medical student engagement

Nearly all responding programs reported conducting MSE activities (32/34, 94.1%). Among programs with established engagement efforts, 14 (43.8%) had conducted these initiatives for more than five years, 8 (25.0%) for four to five years, and six (18.8%) for two to three years. MSE was considered a high priority by 18 programs (58.1%), a moderate priority by 10 (32.3%), and a low priority by three (9.7%). Additionally, 27 respondents (87.1%) believed that MSE should be a formal strategic priority for RO residency programs.

Medical student outreach and recruitment activities

Programs reported utilizing a variety of outreach and recruitment strategies (Figure *2*). The most common activities included formal clinical rotations (n=31, 91.2%), research opportunities (n=31, 91.2%), shadowing experiences (n=30, 88.2%), program-led lectures for medical students (n=18, 52.9%), preclinical observerships (n=17, 50.0%), didactic participation opportunities (n=17, 50.0%), program-hosted open houses (n=16, 47.1%), social media outreach (n=15, 44.1%), and support of RO interest groups (n=14, 41.2%). Only seven programs (20.6%) reported that RO education was incorporated as a required component of their affiliated medical school curriculum.

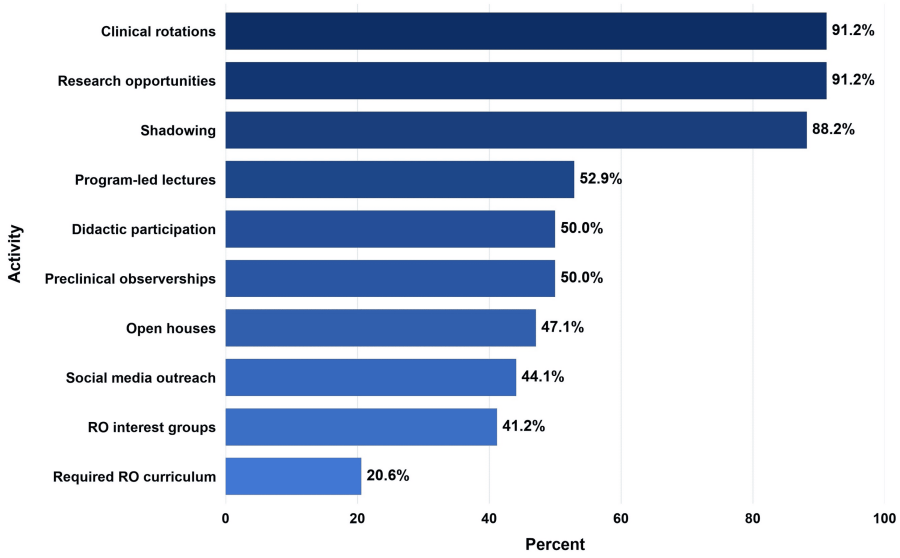


FIGURE 2: Medical student engagement activities currently used by responding programs.

Mentorship infrastructure and research opportunities

Formal mentorship programs for medical students were reported by 13 programs (41.9%), while 18 (58.1%) relied on informal mentorship alone (Figure *3A*). Research mentorship was the most frequently reported mentorship activity (n=29, 85.3%), followed by career advising (n=22, 64.7%), application advising (n=20, 58.8%), resident-led mentorship (n=11, 32.4%), and diversity, equity, and inclusion-focused mentorship initiatives (n=4, 11.8%) (Figure *3B*). Research opportunities for medical students were generally perceived as highly accessible, with 17 respondents (54.8%) reporting that opportunities were “very accessible” and 10 (32.3%) reporting that they were “somewhat accessible.” Three respondents (9.7%) indicated accessibility was dependent on whether the student was internal or external to their institution, while one program (3.2%) reported limited accessibility.

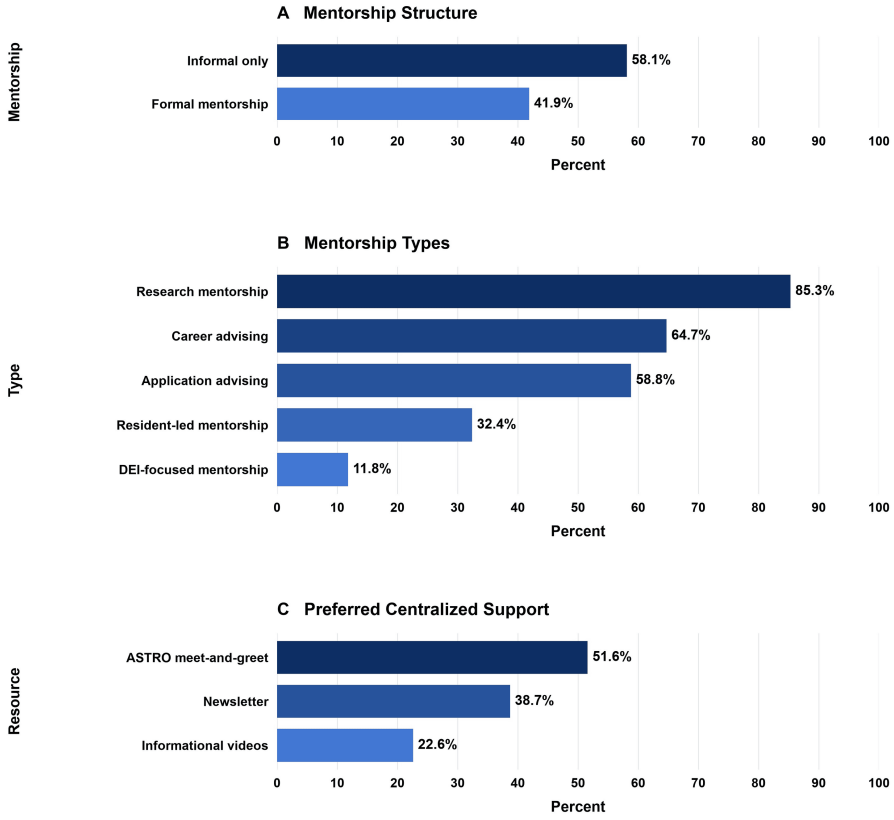


FIGURE 3: Mentorship and need for centralized support.

A: structure of mentorship offered by programs; B: mentorship types offered by programs; C: programs would prefer centralized support for medical student engagement.

ASTRO: American Society for Radiation Oncology

Perceived effectiveness of engagement efforts

Overall satisfaction with the program MSE was high. Fourteen respondents (45.2%) reported being satisfied and nine (29.0%) very satisfied, while six (19.4%) were neutral and two (6.5%) were dissatisfied. Programs reported a variety of measurable benefits associated with their engagement initiatives. The most commonly cited outcomes included increased numbers of medical student rotators (n=20), improved student knowledge of RO (n=17), increased residency applicant numbers (n=12), improved match outcomes (n=9), and increased applicant diversity (n=9). Five programs reported that outcomes had not been formally assessed, and three reported no measurable improvements. Respondents commented on the most successful engagement strategies, which centered on early and sustained exposure to RO, particularly through clinical rotations, clerkships, shadowing, observerships, and research opportunities starting during the first or second year of medical school. Mentorship and relationship-building, such as faculty/student research pairings, panels, networking events, interest-group outreach, residency fairs, and national meeting presence, were also frequently cited as effective approaches for increasing student awareness and interest.

Need for centralized support

Most respondents expressed interest in centralized support for MSE initiatives (Figure *3C*). Twenty-one respondents (67.7%) indicated such support would be useful, while nine (29.0%) reported it might be useful, and only one (3.2%) indicated it would not be beneficial. The most desired forms of centralized support included a medical student networking or meet-and-greet event at national meetings such as the American Society for Radiation Oncology (ASTRO) (n=16), a dedicated newsletter (n=12), and informational video resources (n=7).

Overall, the findings demonstrate widespread commitment among RO residency programs to MSE. There was strong utilization of clinical, research, and mentorship-based outreach activities. Respondents also identified opportunities for enhanced collaboration and centralized resources to further support recruitment and education efforts across the specialty.

Discussion

This national survey provides insight into how RO residency programs approach MSE and highlights both the strengths and limitations of current efforts. Our findings demonstrate that MSE is widely recognized as an important priority within the specialty, with nearly all responding programs reporting active engagement initiatives and most respondents supporting formal integration of MSE into program strategic priorities. Despite this commitment, engagement efforts remain highly variable and largely dependent on individual residency programs, reflecting the absence of a coordinated national approach.

The widespread implementation of clinical rotations, shadowing opportunities, and research experiences underscores the important role residency programs play in introducing medical students to RO [6,12-19,21-29]. These findings are particularly relevant given prior studies demonstrating limited exposure to RO within undergraduate medical education [6,7,22]. Most medical schools do not include dedicated RO curricula, and oncology education is frequently taught through the lens of medical and surgical oncology [6]. Consequently, many students complete medical school with limited understanding of the indications, benefits, and multidisciplinary role of radiation therapy [5]. Our finding that only approximately one-fifth of programs reported RO as a required component of their affiliated medical school curriculum highlights the persistent gap between the importance of radiotherapy in cancer care and its representation in undergraduate medical education [9,22].

Mentorship emerged as another important component of MSE. While most programs reported providing mentorship opportunities, fewer than half had formal mentorship structures. Instead, mentorship often occurred through informal relationships centered on research participation, career advising, and residency application guidance. Informal mentorship can be highly effective but may also result in inconsistent access and variable experiences among students [23-26,28,29]. This finding highlights a persistent disconnect between the clinical importance of radiotherapy in cancer care and its representation in undergraduate medical education. Development of more structured mentorship frameworks could improve accessibility, particularly for students without home RO programs or established departmental connections [23-28]. Such efforts may also support diversification of the applicant pipeline by facilitating earlier exposure and guidance for students from groups historically underrepresented within the specialty [22].

Programs generally perceived their engagement initiatives as successful, citing increased student participation, improved understanding of RO, enhanced recruitment, and favorable match outcomes. Although these outcomes were self-reported and not independently validated, they suggest that MSE initiatives may have meaningful educational and workforce implications. These findings are particularly noteworthy given the decline in RO residency applicants observed over the past decade compared to historical numbers and the increase in unfilled residency positions during recent match cycles, which was highest in the 2021-2023 match cycles [9,10]. While workforce trends are multifactorial, improving awareness of RO among medical students represents a modifiable factor that may help strengthen recruitment into the specialty [9-11].

One of the most important findings from this study was the strong interest in centralized support for MSE efforts. Nearly all respondents indicated that centralized resources would be beneficial or potentially beneficial. Desired resources included networking opportunities at national meetings, dedicated communication platforms, and educational materials. This finding suggests that residency programs recognize both the value of MSE and the challenges associated with independently developing and sustaining engagement initiatives. National organizations such as the ADROP and the ASTRO may be well positioned to facilitate collaboration, disseminate best practices, and develop shared educational resources that can be adapted across institutions. More structured mentorship frameworks may help improve consistency, broaden access, and better support students without a home RO program. Such efforts could reduce duplication of effort, improve consistency in student experiences, and expand access to RO education beyond institutions with robust departmental resources.

Our findings align closely with published experiences from other procedurally oriented and relatively small specialties, including neurosurgery, urology, and pathology. Across these fields, sustained experiential exposure, longitudinal mentorship, early research participation, and specialty interest groups consistently emerge as the most effective strategies for MSE and recruitment [30-32]. Similar to our findings, these specialties identify limited curricular exposure as a major barrier and advocate for integrating specialty-specific education throughout both the preclinical and clinical years rather than relying solely on elective experiences [30-32]. Collectively, these observations suggest that many of the challenges facing RO are not unique and that successful MSE strategies developed in other specialties may provide useful models for future national initiatives.

The findings of this study should be interpreted within the context of several limitations. First, the response rate was modest, and programs with established MSE initiatives may have been more likely to participate, introducing potential response bias. Consequently, the prevalence of engagement activities reported in this study may overestimate the level of activity across all RO residency programs. Second, survey responses were self-reported and may be subject to recall bias or social desirability bias. Third, the survey instrument was developed specifically for this study because no validated tool exists to assess RO residency program

MSE efforts. Fourth, item-level nonresponse may have contributed to variation in denominators across survey analyses. Fifth, the role of the program representative filling out the survey was not tracked. Finally, the study was descriptive in nature and was not designed to determine which specific engagement strategies are most effective at improving student knowledge, recruitment, or workforce outcomes.

Future research should focus on identifying best practices for MSE and evaluating the effectiveness of specific interventions. Studies examining the impact of mentorship programs, curricular integration, national educational resources, and outreach initiatives on student knowledge, specialty perception, and residency application patterns would provide valuable guidance for the field. Additionally, exploration of medical student perspectives may help identify barriers to engagement and opportunities to improve accessibility.

Conclusions

In summary, U.S. RO residency programs demonstrate a strong commitment to MSE through diverse outreach, mentorship, and educational efforts. However, substantial variability exists across programs, and RO remains underrepresented in formal medical school curricula. Greater collaboration and development of centralized resources may help improve consistency, expand student exposure to the specialty, and support future recruitment. Establishing shared educational frameworks and disseminating successful approaches across institutions could reduce duplication of effort while improving access to high-quality RO learning opportunities. Earlier and more consistent exposure may also help students better understand the scope of RO practice and consider the specialty as they explore potential career paths.

Appendices

Item	Survey question	Response options
1	Geographical location of program	Pacific; Mountain; West North Central; West South Central; East North Central; East South Central; New England; Mid Atlantic; South Atlantic
2	Training location	Academic hospital (single site); Academic hospital (multi-site); Community-based; Hybrid (>25% of rotations in community setting)
3	Affiliation with a medical school	Yes/No
4	Program size (total rad onc residents)	0–6; 7–12; >12
5	Conducts medical student engagement initiatives	Yes/No
6	Duration of medical student engagement initiatives	1 year; 2–3 years; 4–5 years; >5 years
7	Individual or committee responsible for outreach	Yes (role description free text); No; In development
8	Extent to which engagement is a priority	High; Moderate; Low; None
9	Whether this should be a more serious initiative	Yes/No
10	Outreach initiatives employed	Multiple select; includes clinical rotations, shadowing, research electives, observerships, didactics, open houses, newsletter, lectures, required curriculum component, social media, interest group, other
11	Structured mentorship for medical students	Yes; Informal only; No
12	Types of mentorship offered	Multiple select; career advising, research mentorship, application advising, resident-led mentorship, DEI-based mentorship, other
13	Accessibility of research opportunities	Very accessible; Somewhat accessible; Limited; Not available; Depends on internal vs external student; Other
14	Satisfaction with current engagement efforts	Very satisfied; Satisfied; Neutral; Dissatisfied; Very dissatisfied
15	Measurable improvements from initiatives	Multiple select; rotators, applicant numbers, applicant diversity, student knowledge, match outcomes, no measurable improvements, not assessed
16	Most successful engagement strategies	Free text
17	New initiatives desired in next 1–3 years	Free text
18	Additional comments or suggestions	Free text
19	Whether centralized support would be useful	Yes/No
20	Centralized initiatives of most interest	Medical student meet and greet at ASTRO; Newsletter; Informational video; Other

TABLE 1: Survey tool.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Lisa A. McGee, Mona Arbab, Steve Braunstein, Nima Nabavizadeh, Albert Attia, Brady Laughlin

Acquisition, analysis, or interpretation of data: Lisa A. McGee, Mona Arbab

Drafting of the manuscript: Lisa A. McGee, Mona Arbab

Critical review of the manuscript for important intellectual content: Lisa A. McGee, Mona Arbab, Steve Braunstein, Nima Nabavizadeh, Albert Attia, Brady Laughlin

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Review Board of Mayo Clinic issued approval 25-006676. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** Steve Braunstein declare(s) personal fees from GTMedTech. Steve Braunstein declare(s) personal fees from Novocure. Steve Braunstein declare(s) personal fees from Servier. Steve Brunstein declare(s) a grant from Merck. Steve Braunstein declare(s) a grant from National Institute of Health. Steve Braunstein declare(s) a grant from Department of Defense. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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