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Scientific Article

Gender and the Receipt of the Association of Residents in Radiation Oncology Educator of the Year Award

Karishma Khullar, MD,[a] Rebecca A. Deek, MS,[b] Bailey Nelson, MD,[c] Dakim Gaines, MD, PhD,[d] Kelsey L. Corrigan, MD, MPH,[e] Michael C. LeCompte, MD,[f] Curtiland Deville Jr, MD,[f] Matthew P. Deek, MD,[g] and Salma K. Jabbour, MD[g,*]

[a]Department of Radiation Oncology, Perelman Center for Advanced Medicine, University of Pennsylvania, Philadelphia, Pennsylvania; [b]Department of Biostatistics, Epidemiology and Informatics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania; [c]Department of Radiation Oncology, University of Cincinnati, Cincinnati, Ohio; [d]Department of Radiation Oncology, Vanderbilt University Medical Center, Nashville, Tennessee; [e]Department of Radiation Oncology, The University of Texas MD Anderson Cancer Center, Houston, Texas; [f]Department of Radiation Oncology and Molecular Radiation Sciences, Johns Hopkins University, Baltimore, Maryland; and [g]Department of Radiation Oncology, Rutgers Cancer Institute of New Jersey, Rutgers University, New Brunswick, New Jersey

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Purpose: We hypothesized that there may be a gender disparity in the receipt of the Association of Residents in Radiation Oncology (ARRO) Educator of the Year Award and sought to elucidate factors that contribute to differences in award receipt.

Methods and Materials: Using a database provided by the American Society for Radiation Oncology, award recipients were identified from 2010 to 2022. Publicly available websites were accessed to obtain data regarding gender, years since residency graduation, percentage of female faculty, size of residency program, and program director designation. A 1-sample Z-test was used to assess whether the proportion of female ARRO award winners, defined as the proportion of female radiation oncology faculty members in the nominating universities that year, was significantly less than the population average. Secondary analyses used univariable binary logistic regression to identify global associations between gender, year since gradation, or program size.

Results: The lowest proportion of female awardees occurred in 2013 (14.3%) and the greatest proportion in 2022 (30.6%). Compared with the proportion of female faculty members in nominating programs for the respective year, there were significantly fewer female awardees in 2010 (18% female awardees vs 32% female faculty members; $P = .02$) and 2013 (14% female awardees vs 31% female faculty members; $P = .01$). There was a statistically significant increase in female awardees during the study period ($P < .01$). On logistic regression analysis, large program size (≥10 residents) (odds ratio [OR], 6.86; 95% CI, 2.71-23.1; $P < .001$) and medium program size (5-9 residents) (OR, 4.05; 95% CI, 1.60-13.7; $P < .001$) were associated with a greater proportion of female awardees compared with small program size (1-4 residents). There was no association between awardee gender and years since graduation.

Conclusions: A gender disparity was present in the receipt of ARRO Educator Awards. Residency chiefs, program directors, and chairs should work to ensure that a diverse slate of faculty is considered annually for the ARRO Educator Award.

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Research data are stored in an institutional repository and will be shared upon request to the corresponding author.

*Corresponding author: Salma K. Jabbour, MD; email: jabbousk@cinj.rutgers.edu

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Introduction

Although women have been historically underrepresented in medicine, this disparity has progressively diminished over time. Since 2017, women have outnumbered men in being admitted to medical school,[1] and in 2019, 41% of active physicians in the workforce were women.[2] Despite this increase in female trainees and physicians, women remain underrepresented in the field of radiation oncology. Among the largest residency training specialties, radiation oncology ranks near the bottom regarding female representation, and only 28.9% of practicing radiation oncologists are women.[3] There is a gender disparity not only in the number of female physicians but also in career advancement and the ability of women to attain leadership positions and awards. In academic medicine, several prior studies have demonstrated that women are less likely to become full professors and to fill leadership positions.[4-7] The cause for these disparities is likely multifactorial, including factors such as the historical lack of female mentors or role models, overt and implicit bias and exclusion, and gendered expectations for familial responsibilities.[8,9]

The gender disparity is particularly stark in radiation oncology, as evidenced by the fact that there have been only 6 female presidents of the American Society for Radiation Oncology (ASTRO) in the past 60 years and only 14% of professors and chairpersons in the field were women in 2015.[10] Prior studies in radiation oncology have demonstrated that female faculty have a lower median number of publications and fewer faculty promotions as well as less financial compensation than their male colleagues.[10,11] Although prior studies have identified several gender-based disparities in radiation oncology, there has been a scarcity of data looking at education awards for female radiation oncologists. The Association of Residents in Radiation Oncology (ARRO) presents an Educator of the Year award to radiation oncology faculty at participating institutions each year to recognize excellence in teaching. The purpose of this study was to examine patterns of receipt for ARRO educator awards from 2010 to 2022. We hypothesized that there may be a gender disparity in the receipt of ARRO educator awards and sought to elucidate factors that may contribute to differences in award receipt.

Methods and Materials

Using a database generated and provided by ASTRO, annual award recipients were identified from 2010 to 2022 for this retrospective review. The study was approved by the ARRO Executive Committee. Institutional review board exemption was obtained. Awardees were cross-referenced using publicly available websites. Data pertaining to academic institution at the time of the award, year of award, and repeat awardee status were obtained through the ASTRO database. Publicly available websites including institutional biographies, public curriculum vitae, and residency program websites were accessed to obtain data regarding gender, years since residency graduation at the time of the award, the percentage of female and male faculty, size of the residency program, and program director designation. If information regarding the size of the residency program and the percentage of female and male faculty were not available for the year of award receipt—as was often the case—then currently available data for the year 2022 were used. H-indices were obtained from Scopus and used as a marker of academic productivity. Self-reported gender was not available; therefore, binary gender (man or woman) was assigned based on legal name and investigator review. The Gender Balance Assessment Tool (GBAT) was used to objectively validate gender assignment. The GBAT is a web-based tool that estimates the probability of a name representing a man or woman, based on United States–based data.[12] Any gender discrepancies were resolved by investigator review of the legal name. For the purposes of this analysis, gender was defined as binary man or woman and may be used interchangeably with the binary sex classification of male or female.

Statistical analysis

Basic summary statistics, stratified by gender, were calculated for award year, years since graduation, percentage of male faculty, and program size. A 1-sample (less than) Z-test for proportions was used to assess whether the proportion of female ARRO award winners each year from 2010 to 2022, defined as the proportion of female radiation oncology faculty members in the nominating universities for the respective year, was significantly less than the population average. Secondary analyses used univariable binary logistic regression to identify any global associations between gender, years since gradation, or program size. All statistical analyses were computed in R, version 4.2.2, and a P value $<.05$ was considered statistically significant.

Results

Population characteristics

A total of 697 individuals received an ARRO Educator of the Year award during the 13-year period from 2010 to

2022 and were included for analysis. Of those, 526 (75.4%) were identified as men and 171 (24.5%) were identified as women. The GBAT estimated that 19% of the recipients were women, 79% were men, and 2% were of unknown gender based on their name, which was similar to subjective assignment. The median (interquartile range) time since graduation for female awardees was 7 (4-16) years and for male awardees was 8 (4-18) years. More awardees from medium-sized programs (5-9 residents) were male (52% vs 44% female), whereas more awardees from large programs (≥10 residents) were female (54% vs 37% male). The remaining awardee characteristics are described in Table 1, and the breakdown of male faculty by program size is described in Table 2.

The lowest proportion of female awardees occurred in 2013 (8 females [14.3%] vs 48 males [85.7%]), and the greatest proportion of female awardees occurred in 2022 (19 females [30.6%] vs 43 males [69.4%]). Compared with the proportion of female faculty members in nominating programs for the respective year, there were significantly fewer female awardees in 2010 (18% female awardees vs 32% female faculty members; $P = .02$) and 2013 (14% female awardees vs 31% female faculty members; $P = .01$) (Table 3). There was a statistically significant increase in female awardees during the study period ($P < .01$) (Fig. 1).

On logistic regression analysis, large program size (≥10 residents) (odds ratio [OR], 6.86; 95% CI, 2.71-23.1; $P < .001$) and medium program size (5-9 residents) (OR, 4.05; 95% CI, 1.60-13.7; $P < .001$) were associated with a greater proportion of female awardees compared with small program size (1-4 residents). There was no association between awardee gender and years since graduation (both $P > .05$) (Table 3).

Discussion

Seventy-five percent of the ARRO Educator of the Year award recipients from the past decade were men. Interestingly, our study showed that more awardees from large programs were female, and the proportion of female awardees increased over time (Fig. 1). In addition, in our analysis, large and medium programs were associated

Table 1 *Award* **recipient characteristics**

Characteristic	Female recipients (n = 171)*	Male recipients (n = 526)*
Year awarded		
2010	9 (5.3)	42 (8.0)
2011	7 (4.1)	32 (6.1)
2012	9 (5.3)	36 (6.8)
2013	8 (4.7)	48 (9.1)
2014	17 (9.9)	40 (7.6)
2015	15 (8.8)	43 (8.2)
2016	13 (7.6)	42 (8.0)
2017	14 (8.2)	42 (8.0)
2018	16 (9.4)	39 (7.4)
2019	14 (8.2)	44 (8.4)
2020	15 (8.8)	42 (8.0)
2021	15 (8.8)	33 (6.3)
2022	19 (11)	43 (8.2)
Time since graduation, y	7 (4-16)	8 (4-18)
Missing	14	65
Proportion of male faculty in program, %	63 (54-75)	71 (63-80)
Missing	47	146
Program size		
1-4 residents	4 (2.4)	57 (11)
5-9 residents	73 (44)	257 (52)
10 or more residents	89 (54)	185 (37)
Missing	5	27

*Data are presented as the number (percentage) or median (interquartile range).

Table 2 Percentage of male faculty in the program, split by program size

Characteristic	1-4 residents (n = 61)	5-9 residents (n = 330)	10 Or more residents (n = 274)
Proportion of male faculty, median (IQR), %	76 (69-80)	71 (57-80)	67 (60-77)
Missing	15	73	78

Abbreviation: IQR = interquartile range.

with a greater proportion of female awardees compared with small programs.

A recent editorial published on expanding female leadership in academic medicine pointed out that trainees in smaller programs may have less access to established mentors.[13] Consequently, radiation oncology residents in small programs may have less access to female faculty and female mentorship, which could explain the lower proportion of female recipients of the ARRO Educator of the Year award from these programs, as found in this study. A survey of female radiation oncology residents in 2017 to 2018 found that many residents (85%) had at least 1 male radiation oncology mentor during medical school, and over half of the respondents (57%) had at least 1 female radiation oncology mentor.[14] Male mentorship starts earlier owing to decreased exposure to female mentors. Fifty-eight percent of the respondents in the same study agreed that females were underrepresented in their own residency program. The vast majority agreed that gender-specific biases exist for women in the field. About 90% of the surveyed women indicated interest in joining a supportive professional group.[14] Studies in other specialties such as internal medicine have also found that female residents are more likely than male residents to perceive gender disparities among faculty leadership and educational positions.[15] Additionally, smaller programs may have fewer female residents, which may also contribute to the bias toward male faculty awardees. Organizations such as the Society for Women in Radiation Oncology strongly advocate for women in this field, especially female trainees. The Society for Women in Radiation Oncology has a mentorship program to help meet the need for female mentors within the field and to aid in providing education and connections among women residents, junior faculty, and senior leaders. Efforts to mitigate burnout among female physicians would likely increase time for mentorship. These efforts could include but are not limited to implementing harassment training, reducing administrative burdens, and standardizing parental leave policies, which can foster more favorable work environments.

Another potential reason that women are less recognized as outstanding educators is that gender bias can contribute to resident assessments of faculty. Although the ARRO Educator Award is not a direct written assessment of the faculty, this award does consider resident opinions about their educators. Tiedt et al evaluated associations between faculty gender and teaching assessment scores assigned by residents in a midsized pediatric residency program.[16] Nearly 3000 assessments of 104 faculty

Table 3 Proportion of female ARRO Educator Award winners by year from 2010 to 2022*

Year	Female winners, proportion (95% CI)	Population average	*P* value
2010 (n = 51)	0.18 (0-0.29)	0.32	.02
2011 (n = 39)	0.18 (0-0.31)	0.28	.12
2012 (n = 45)	0.2 (0-0.33)	0.31	.08
2013 (n = 56)	0.14 (0-0.25)	0.31	.01
2014 (n = 57)	0.3 (0-0.41)	0.32	.39
2015 (n = 58)	0.26 (0-0.37)	0.32	.18
2016 (n = 55)	0.24 (0-0.35)	0.33	.09
2017 (n = 56)	0.25 (0-0.36)	0.31	.20
2018 (n = 56)	0.29 (0-0.39)	0.29	.50
2019 (n = 59)	0.24 (0-0.35)	0.28	.27
2020 (n = 57)	0.26 (0-0.38)	0.31	.28
2021 (n = 48)	0.31 (0-0.44)	0.31	.50
2022 (n = 62)	0.31 (0-0.42)	0.29	.53

Abbreviation: ARRO = Association of Residents in Radiation Oncology.
**P* values from 1-sample Z-test for proportions, with a 1-sided alternative.

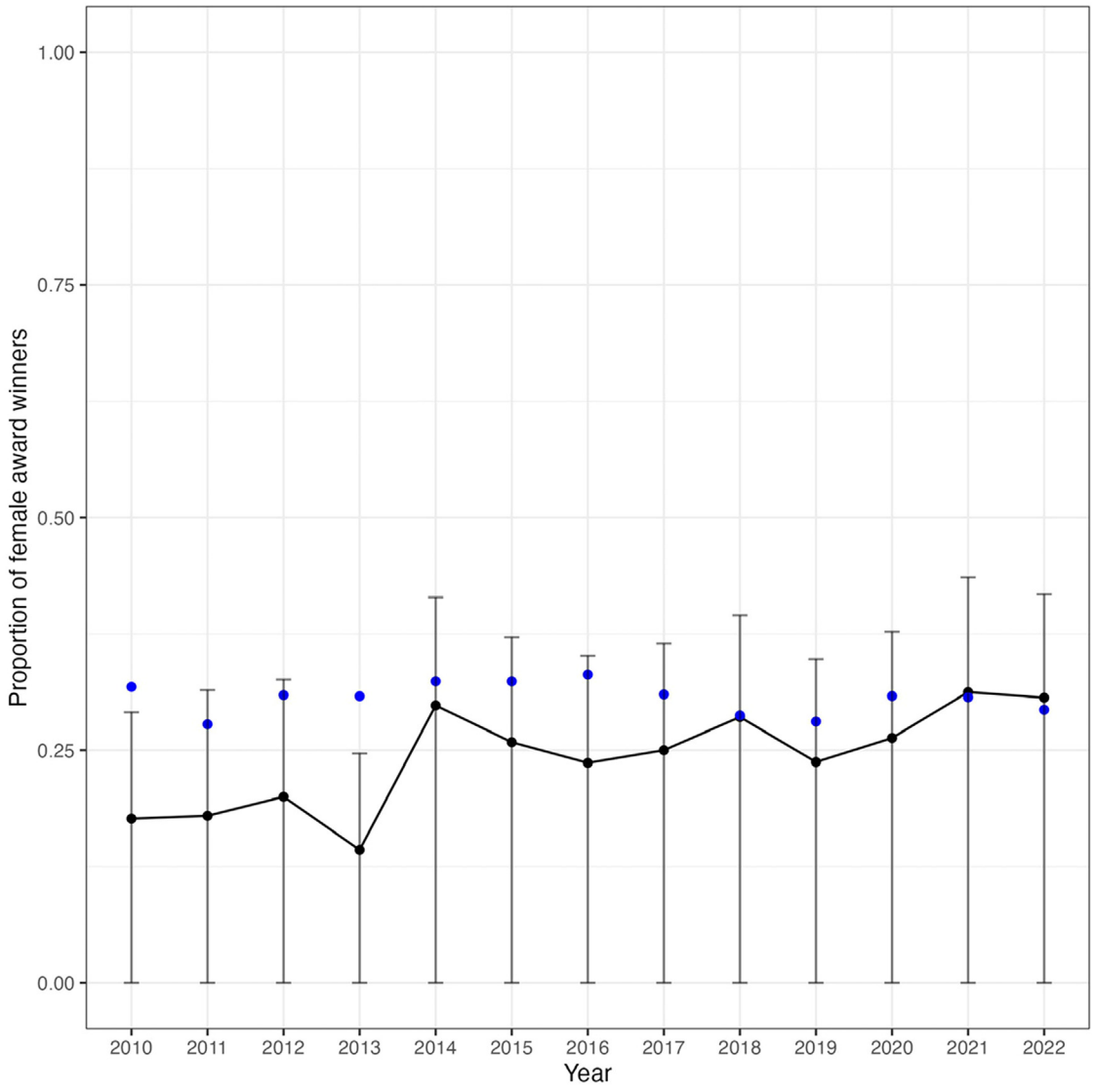

Figure 1 The black dots and solid black line represent the proportion of female Association of Residents in Radiation Oncology Educator Award recipients by year from 2010 to 2022. The gray bars represent the 95% confidence intervals of the proportion of female recipients for each year. The blue dots indicate the population average of female academic radiation oncologists for that year. There was a statistically significant increase in female awardees during the study period ($P < .01$).

members were performed by 91 residents, with no significant differences in the odds of receiving a score in the top quartile for the domains of clinical interactions, teaching, and role modeling and/or professionalism. However, women were more likely to score in the bottom quartile for teaching and role modeling and had lower odds of receiving the highest scores in subcompetencies. Taken together, the findings of the study suggested that gender bias can a play a role in resident assessments. Similarly, Sheffield et al found gender-based differences in the assessment of general internal medicine physicians by trainees in inpatient and outpatient settings.[17] Male faculty were rated higher in overall teaching ability in 4 of the 6 Accreditation Council for Graduate Medical Education competencies. In the inpatient setting, male faculty were rated significantly more favorably for overall teaching and across all Accreditation Council for Graduate Medical Education competencies. The only observed gender difference in the outpatient setting favored female faculty for patient care.[17] Therefore, the possibility for propagating gender bias via evaluation systems and the ARRO mechanism may exist, and efforts to address trainees and faculty on implicit biases may be warranted.

Amdur et al suggested that it may be easier to increase resident diversity than faculty diversity but that resident diversity may facilitate increased faculty diversity.[18] This idea was confirmed by a cross-sectional study that showed a positive correlation between the proportion of female attending and resident physicians.[19] A published analysis of gender characteristics in ophthalmology residency

Table 4 Considerations to improve gender disparity for the ARRO Educator of the Year Award

Identified difficulty in ARRO Educator of the Year	Recommendation
Limited availability of self-reported demographic data for the award	For future data collection, demographics such as self-reported gender, race, and ethnicity should be objectively collected on the ARRO Educator of the Year nomination forms. With accurate demographic data, these disparities can be better addressed.
Low proportion of female awardees within departments	At an institutional level, residency chiefs, program directors, and chairs should work to ensure that a diverse slate of faculty are considered annually for the ARRO Educator Award, with self-assessment of awardees over time to ensure demographic representation and inclusion.
Low proportion of female awardees nationally	At a societal level, ARRO, ADROP, and SCAROP should consider short- and long-term assessments to ensure equity and diverse representation in the awards process.
Existing biases in resident evaluations of faculty	Programs should work to recognize biases in resident evaluations of faculty with continued education about inherent biases.
Limited mentorship availability for female faculty	Mentorship and networking among female trainees, faculty, and leaders should continue to be promoted.

Abbreviations: ADROP = Association for Directors of Radiation Oncology Programs; ARRO = Association of Residents in Radiation Oncology; SCAROP = Society of Chairs of Academic Radiation Oncology Programs.

training programs showed that the gender of the department chair was not significantly associated with the proportion of female program directors, female faculty, or female residents.[20] However, programs with a female program director and a high proportion of female faculty had a higher proportion of female residents.[20] Departments with successful mentorship programs require gender diversity at both the residency and faculty levels.

Women are underrepresented in leadership positions in academic medicine. Gender disparity is magnified at the chair level, and programs with women in leadership positions are associated with a higher proportion of female faculty.[21] On average, women have significantly lower H-indices than men.[22] Females in academics do more internal administrative work than their male counterparts,[23] which likely decreases time available for research and mentorship. Vanderbilt University's Department of Radiology created a female faculty development program consisting of a series of educational modules to create a supportive environment for the career advancement of female faculty.[24] The program promoted engagement of junior and senior faculty members and strengthened intradepartmental mentoring. Such programs should be considered by radiation oncology departments to increase female mentorship and leadership. Similar efforts could increase the number of female recipients of the ARRO Educator of the Year award.

Our study has several limitations. First, data procurement for this study was subjective and relied on publicly accessible information; the data provided by ASTRO relied on member reporting and have not been independently verified. Second, as mentioned earlier, in cases where data for variables at the time of the award were not available, currently available data were used, which adds uncertainty to our findings. Third, data on race and ethnicity were not reliably available, so associations with regard to race and ethnicity and award receipt remain unclear. Nevertheless, our study offers important insight on disparities that exist in radiation oncology with regard to acknowledgment and recognition of teaching excellence.

Given the findings of our analysis, considerations to build upon these results include the following (Table 4):

1) For future data collection, we recommend that demographic information such as self-reported gender, race, and ethnicity be objectively collected on the ARRO Educator of the Year nomination forms. With accurate demographic data, disparities can be better addressed.
2) At an institutional level, residency chiefs, program directors, and chairs should work to ensure that a diverse slate of faculty is considered annually for the ARRO Educator Award, with self-assessment of awardees over time to ensure demographic representation and inclusion.
3) At a societal level, the ARRO, the Association for Directors of Radiation Oncology Programs, and the Society of Chairs of Academic Radiation Oncology Programs should consider short- and long-term assessments to ensure equity and diverse representation in the awards process.
4) Programs should work to recognize biases in resident evaluations of faculty, with continued education about inherent biases.

5) As a specialty, radiation oncology should continue to promote mentorship and networking among female trainees, faculty, and leaders.

Conclusion

In the past decade, only one-quarter of the ARRO Educator of the Year award recipients were female, which could be due in part to decreased exposure to female faculty educators and mentors and to evaluation biases. The gender disparity could be mitigated by increasing gender diversity within departments, recognizing biases in the residency evaluations of female faculty, encouraging participation in professional societies that support women, and developing programs aimed at advancing female faculty. An equal distribution of administrative work within departments may also provide women with more time for research and trainee mentorship. We expect that the gender disparity will continue to lessen owing to improvements in awareness and support through female recruitment, retention, and advancement.

Disclosures

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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