

Brief Opinion

Cross-Sectional Gender Analysis of US Radiation Oncology Residency Programs in 2019: More Than a Pipeline Issue?



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Abstract

Purpose: The purpose of this study is to assess the current status of gender disparities in academic radiation oncology departments in the United States and the associated factors.

Methods and Materials: The data were collected from publicly available resources, including websites of individual radiation oncology programs, the Fellowship and Residency Electronic Interactive Database, the Accreditation Council for Graduate Medical Education, and the Association of American Medical Colleges. We collected data on the gender information of residents in each year (postgraduate years 2-5) and of the faculty (attendings, program director, and chair) during the academic year 2018 to 2019. Spearman's rho test, Pearson's chi-squared test, and Fisher exact tests were used for evaluating the correlation among variables using SPSS version 24.

Results: Women constituted 30.8% of radiation oncology residents in the United States in 2019. Eight programs (12.5%) did not have any female residents in their programs, whereas 6 programs (9%) had women constituting more than half of their resident class. The fraction of female medical students applying to radiation oncology over the last 7 years varied between 27% and 33%. Female attending physicians accounted for 30.5% of all the attending physicians in the academic programs. In the leadership positions of the department, the gender gap was wider where only 19 (20%) and 11 (12%) of programs had female program director or chair, respectively. There was a positive correlation between the number of attending physicians and the number of female residents in programs ($P = .01$).

Conclusions: A significant gender disparity continues to exist among the residents and physicians in the academic radiation oncology departments in the US. This disparity is pronounced in the leadership positions. The results of this study could be used as a benchmark to evaluate the progress that has been made by the efforts to improve gender disparities in radiation oncology.

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Introduction

Currently, male and female matriculants to US medical schools are approximately equal, which is an applaudable change from the 1960s when women accounted for only a

small percentage of medical school attendees.¹ Despite this significant rise in female medical school graduates, women remain underrepresented in certain specialties in academic medicine, particularly surgery,² neurosurgery,³ radiation oncology,^{4,5} and radiology.⁶ A significant gender disparity exists in the radiation oncology workforce, where women constitute only 28.9% of practicing radiation oncologists.⁷

There have been multiple efforts to improve the gender disparities in radiation oncology over the years.^{4,8-12} The purpose of this study is to assess the status of gender disparities in academic radiation oncology departments in the United States during 2018 to 2019 and the factors associated with those disparities.

Methods and Materials

This study was considered exempt by the institutional review board because the data were collected from the publicly available resources, including websites of individual radiation oncology programs, the Fellowship and Residency Electronic Interactive Database (www.freida.ama-assn.org), the Accreditation Council for Graduate Medical Education (ACGME; www.acgme.org), and the Association of American Medical Colleges (www.aamc.org). We collected data on the gender information of residents in each year (postgraduate year 2-5) and of the faculty (attendings, program director, and chair) during the academic year 2018 to 2019. The primary source of information was program websites, and other websites were used to find the missing information. We used the photos and the names of the individuals in the program websites to define gender information. The data regarding 94 ACGME accredited radiation oncology residency programs were collected, and the data collection was finalized by April 30, 2019. We analyzed the data using Excel 2016 and SPSS version 24. Spearman's rho test, Pearson's chi-squared test, and Fisher exact tests were used for evaluating the correlation among variables.

Results

Out of all 94 ACGME accredited radiation oncology residency programs, 74 programs (79%) had information about residents on their websites, but gender information about all the residents were available only in 64 programs (68%). The gender information of the attending physicians was available in 88 programs (94%). The program director and chair's gender information were available in all the 94 programs (100%).

Of the academic residency programs where the gender information of the residents was publicly available ($n = 64$), women constituted 30.8% of radiation oncology residents in the United States in 2019 (Fig 1). Eight

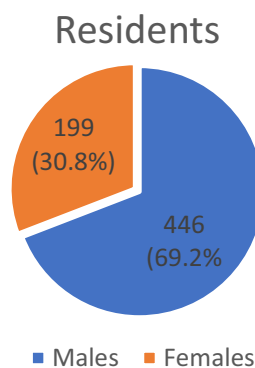


Figure 1 Fraction of female residents in radiation oncology during the academic year 2018-2019. The gender data of residents were available in 64 (68%) programs.

programs (12.5%) did not have any female residents in their programs, whereas 6 programs (9%) had women constituting more than half of their resident class. As depicted in Figure 2, the fraction of female residents varied between 22.8% and 37.2%. Similarly, the fraction of female medical students applying to radiation oncology over the last 7 years varied between 27% and 33% (Fig 3).¹³

Female attending physicians accounted for 30.5% of all the attending physicians in the academic residency programs where the gender information of faculty was available ($n = 88$). Four programs (4.25%) did not have any female attending physicians, whereas in 4 programs, women constituted more than half of the faculty. In 50 programs (53%), women constituted at least a quarter of the faculty positions. In the leadership positions of the department, the gender gap was wider where only 19 (20%), and 11 (12%) of 94 programs had a female program director or chair, respectively (Fig 4).

We evaluated the factors affecting the percentage of female residents in programs (included only the programs where gender information of residents and faculty were available) using Spearman's ($n = 64$) test. There was a positive correlation between the number of attending physicians and the number of female residents in programs ($P = .01$). This correlation was valid over all the postgraduate years (Fig 5). The association between having a female chair or a female program director on the number of female residents or the number of female faculty was evaluated using the Pearson's chi-square test and Fisher exact tests. There was no association between the number of female residents and having a female program director ($P = .75$) or a female chair ($P = .355$) in the department.

Discussion

In this cross-sectional study of radiation oncology residents, faculty, and leadership during the academic

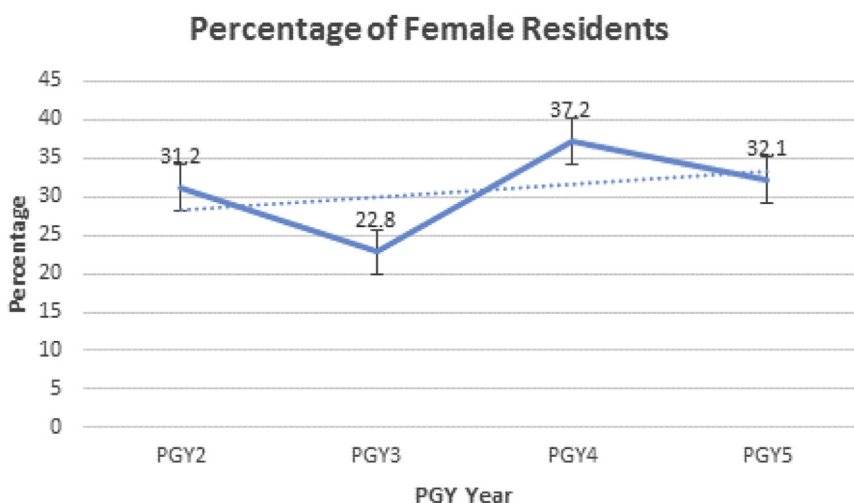


Figure 2 Trend in the fraction of female residents across PG years during the academic year 2018-2019. The gender information of residents were available in 64 (68%) of programs.

year 2018 to 2019, we evaluated the proportion of women among radiation oncology residents, faculty, and program leadership. Ahmed et al reported an increase in the number of female radiation oncology residents from 27.1% to 33.3% from 1980 to 2010, and currently, it is 30.8% from our study.¹² In the same report, the authors reported an increase in the proportion of women in radiation oncology full-time faculty from 11.0% to 26.7% during the same time frame. Chapman et al reported in 2012 that the representation of female radiation oncology residents has increased between 2003 and 2010 academic years, compared with practicing radiation oncology physicians.⁹ Holliday et al reported 28% of academic faculty are women in 2014. In our study of radiation oncology residency programs, we found this proportion was 30.5% in 2019. In a previous study by Wilson et al, 24% of the program directors and 9% of the chairs were women in 2012, compared with 20% and 12%, respectively, from our study.¹⁴ Fung et al reported from the 2017 American Society for Radiation Oncology radiation oncologist workforce survey that there had been an increase in female representation in the workforce to 28.6% compared with 26% in 2012.^{7,15} All these studies point toward a

slow but steady improvement in the proportion of women in the field of radiation oncology from the 1980s, but not more recently.

Based on data from the Association of American Medical Colleges, the percentage of female applicants applying to radiation oncology residency positions has remained mostly flat, between 27% and 33%, since 2012.¹³ These data suggest that efforts to improve gender diversity in radiation oncology applicants may help improve overall gender parity within the field. Data from other fields have shown the importance of female role models within medical specialties with low percentages of women.¹⁶ Our data corroborate this, as we found a positive correlation between the number of female radiation oncology faculty and the number of female radiation oncology residents at a program. We hypothesize this correlation might be due to the department culture that supports female faculty.¹⁷

Prior work has shown us that the observed gender disparity in academic radiation oncology is not purely a pipeline issue. Gender disparities in salary, research funding, and access to academic resources have been well documented.¹⁸⁻²¹ Women are paid less than male physicians, and there are well-documented barriers to promotion for women that result in disparities in time to and attainment of promotion.²² Part-time employment was more common among female radiation oncologists ($P < .01$) compared with male counterparts.²³ Additionally, women were also less likely than men to receive an R01 award.^{2,24} Female physicians are significantly less likely than male physicians to be full professors, even after accounting for age, experience, specialty, and research and clinical productivity measures.² Female representation decreased with increasing academic rank, and disparity also exists in the leadership positions in many specialties like radiology,²⁵ orthopedic,²⁶ and radiation

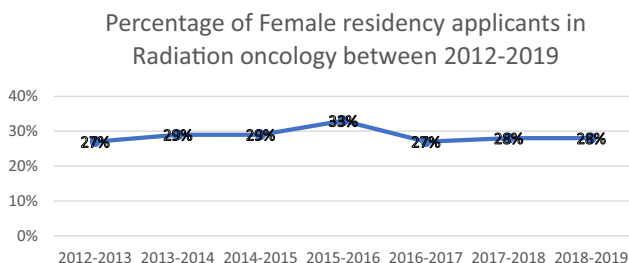


Figure 3 Trend in the fraction of female medical student applicants to radiation oncology residency positions during the academic years between 2012 and 2019.

Female faculty: 30.5%

Female PDs: 20%

Female Chair : 12%

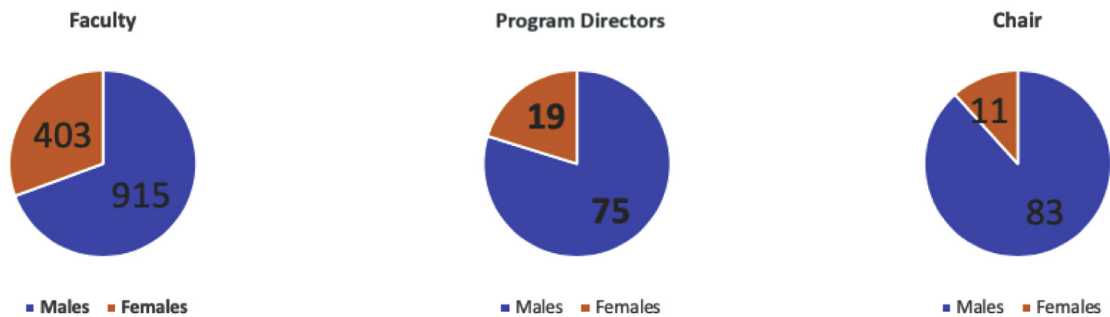


Figure 4 Widening gender gap in the leadership positions in the radiation oncology academic programs during the academic year 2018-2019. Please note, the gender information of all the faculty was available in 88 (94%) and program directors and chairs were available in 94 (100%) programs.

oncology in the United States. These factors may contribute to observed gender differences in retention and promotion in radiation oncology similar to other medical specialties.²⁷

It is essential to acknowledge the improvements made in the field, especially in the leadership positions of the radiation oncology specialty societies in recent years. In November 2018, there have been awareness programs on the social platform to raise awareness about the disparity in radiation oncology.⁸ We hope having more women leaders, sponsors, and mentors will encourage more

women medical students to enter into the field of radiation oncology in the future.^{28,29} However, mentoring women should not solely be on women; male mentors also need to mentor women and create a departmental culture that supports all individuals, regardless of gender.

We acknowledge that our study has several limitations. We collected the data primarily from the program websites. Program websites are limited as they are neither comprehensive nor up-to-date.³⁰ The gender information of residents was available only in 64 programs (68%), limiting our analysis’s power. These data represent the

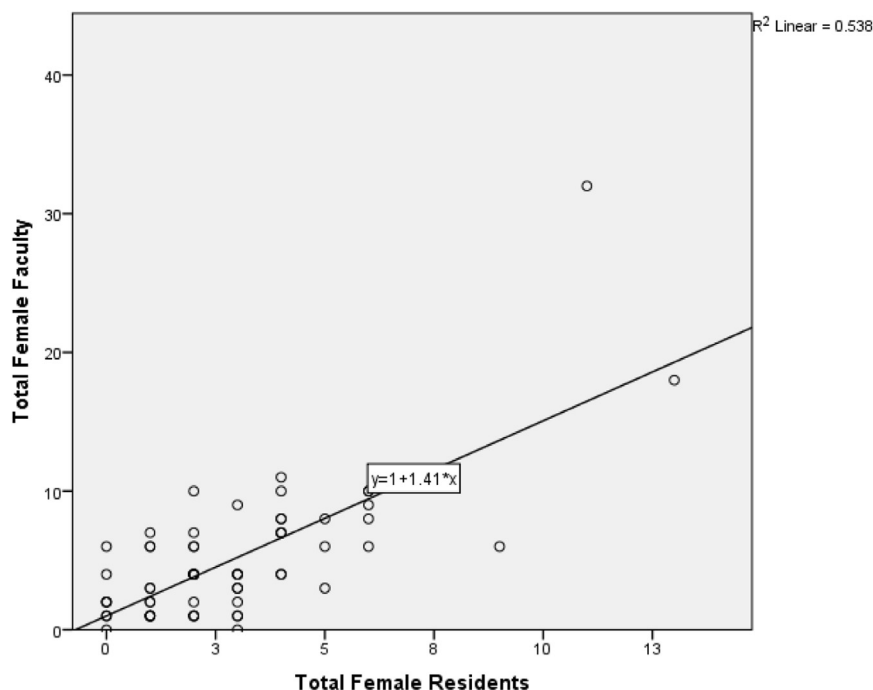


Figure 5 Correlation between the number of female residents and female faculty in radiation oncology residency programs during the academic year 2018-2019.

snapshot of academic residency programs during 2018 to 2019, and the proportion of residents and faculty changes every year. We studied only academic departments with radiation oncology residencies, so our study may not represent other academic institutions without a residency.

Conclusions

A significant gender disparity exists among the residents and physicians in the radiation oncology residency programs in the United States. This disparity is pronounced in the leadership positions. The results of this study could be used as a benchmark to evaluate the progress that had been made by the efforts to improve gender disparities in radiation oncology.

References

1. U.S. medical school applicants and matriculants by school, state of legal residence, and sex, 2019-2020. Available at: <https://www.aamc.org/data-reports/students-residents/interactive-data/2019-facts-applicants-and-matriculants-data>. Accessed August 5, 2020.
2. Greenberg CC. Association for Academic Surgery presidential address: Sticky floors and glass ceilings. *J Surg Res*. 2017;219:ix-xviii.
3. Odell T, Toor H, Takayanagi A, et al. Gender disparity in academic neurosurgery. *Cureus*. 2019;11:e4628.
4. Ahmed AA, Hwang WT, Holliday EB, et al. Female representation in the academic oncology physician workforce: Radiation oncology losing ground to hematology oncology. *Int J Radiat Oncol Biol Phys*. 2017;98:31-33.
5. Chapman CH, Hwang WT, Deville C. Diversity based on race, ethnicity, and sex, of the US radiation oncology physician workforce. *Int J Radiat Oncol Biol Phys*. 2013;85:912-918.
6. Arriola A. Addressing gender disparity in radiology through increased mentorship and earlier authorship. *J Am Coll Radiol*. 2019;16:901.
7. Fung CY, Chen E, Vapiwala N, et al. The American Society for Radiation Oncology 2017 radiation oncologist workforce study. *Int J Radiat Oncol Biol Phys*. 2019;103:547-556.
8. Albert AA, Knoll MA, Doke K, et al. #WomenWhoCurie: Leveraging social media to promote women in radiation oncology. *Adv Radiat Oncol*. 2019;4:218-225.
9. Chapman CH, Hwang WT, Deville C. Diversity based on race, ethnicity, and sex, of the US radiation oncology physician workforce. *Int J Radiat Oncol Biol Phys*. 2013;85:912-918.
10. Deville C, Chapman CH, Burgos R, Hwang WT, Both S, Thomas CR. Diversity by race, Hispanic ethnicity, and sex of the United States medical oncology physician workforce over the past quarter century. *J Oncol Pract*. 2014;10:e328-e334.
11. Holliday EB, Jagsi R, Thomas CR, Wilson LD, Fuller CD. Standing on the shoulders of giants: Results from the Radiation Oncology Academic Development and Mentorship Assessment Project (ROADMAP). *Int J Radiat Oncol Biol Phys*. 2014;88:18-24.
12. Ahmed AA, Egleston B, Holliday E, Eastwick G, Takita C, Jagsi R. Gender trends in radiation oncology in the United States: A 30-year analysis. *Int J Radiat Oncol Biol Phys*. 2014;88:33-38.
13. Table C-1: Residency applicants to ACGME- accredited programs by specialty and sex. Available at: <https://www.aamc.org/system/files/reports/1/factstablec1.pdf>. Accessed August 30, 2019.
14. Wilson LD, Haffty BG, Smith BD. A profile of academic training program directors and chairs in radiation oncology. *Int J Radiat Oncol Biol Phys*. 2013;85:1168-1171.
15. Pohar S, Fung CY, Hopkins S, et al. American Society for Radiation Oncology (ASTRO) 2012 workforce study: The radiation oncologists' and residents' perspectives. *Int J Radiat Oncol Biol Phys*. 2013;87:1135-1140.
16. Hill E, Vaughan S. The only girl in the room: How paradigmatic trajectories deter female students from surgical careers. *Med Educ*. 2013;47:547-556.
17. Bauman MD, Howell LP, Villablanca AC. The Women in Medicine and Health Science program: An innovative initiative to support female faculty at the University of California Davis School of Medicine. *Acad Med*. 2014;89:1462-1466.
18. Guss ZD, Chen Q, Hu C, Guss LG, DeWeese TL, Terezakis SA. Differences in physician compensation between men and women at United States public academic radiation oncology departments. *Int J Radiat Oncol Biol Phys*. 2019;103:314-319.
19. Jagsi R, Griffith KA, Stewart A, Sambuco D, DeCastro R, Ubel PA. Gender differences in salary in a recent cohort of early-career physician-researchers. *Acad Med*. 2013;88:1689-1699.
20. Jagsi R, Motomura AR, Griffith KA, Rangarajan S, Ubel PA. Sex differences in attainment of independent funding by career development awardees. *Ann Intern Med*. 2009;151:804-811.
21. Holliday EB, Jagsi R, Wilson LD, Choi M, Thomas CR, Fuller CD. Gender differences in publication productivity, academic position, career duration, and funding among U.S. academic radiation oncology faculty. *Acad Med*. 2014;89:767-773.
22. Achkar E. Will women ever break the glass ceiling in medicine? *Am J Gastroenterol*. 2008;103:1587-1588.
23. Loewen SK, Doll CM, Halperin R, et al. Taking stock: The Canadian Association of Radiation Oncology 2017 radiation oncologist workforce study. *Int J Radiat Oncol Biol Phys*. 2019;105:42-51.
24. Eloy JA, Svider PF, Kovalerchik O, Baredes S, Kalayoussif E, Chandrasekhar SS. Gender differences in successful NIH grant funding in otolaryngology. *Otolaryngol Head Neck Surg*. 2013;149:77-83.
25. Hamidizadeh R, Jalal S, Pindiprolu B, et al. Influences for gender disparity in the radiology societies in North America. *AJR Am J Roentgenol*. 2018;211:831-838.
26. Brown MA, Erdman MK, Munger AM, Miller AN. Despite growing number of women surgeons, authorship gender disparity in orthopaedic literature persists over 30 years. *Clin Orthop Relat Res*. 2020;478:1542-1552.
27. Chaiyachati KH, Liao JM, Weissman GE, et al. Gender differences in retention and promotion among generalists who graduated from research-intensive fellowships. *J Grad Med Educ*. 2019;11:535-542.
28. Osborn VW, Doke K, Griffith KA, et al. A survey study of female radiation oncology residents' experiences to inform change. *Int J Radiat Oncol Biol Phys*. 2019 Aug 1;104:999-1008.
29. Barry PN, Miller KH, Ziegler C, Hertz R, Hanna N, Dragun AE. Factors affecting gender-based experiences for residents in radiation oncology. *Int J Radiat Oncol Biol Phys*. 2016;95:1009-1016.
30. Prabhu AV, Karukonda P, Hansberry DR, Heron DE, Thomas CR. A window to internet-based information seeking of US fourth-year medical students: Are radiation oncology residency program websites comprehensive? *Int J Radiat Oncol Biol Phys*. 2018;101:789-791.