

The Association of Departmental Leadership Gender With That of Faculty and Residents in Radiology¹

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Rationale and Objectives. Although the number of women graduating from medical school continues to increase, their representation in radiology residency programs has not increased over the past 10 years. We examined whether the gender of radiology faculty and residents differed according to the gender of the departmental leadership.

Materials and Methods. We issued an anonymous Web-based survey via e-mail to all 188 radiology residency program directors listed in the Fellowship and Residency Electronic Interactive Database (FREIDA Online). Data regarding the gender of the department chairperson, residency program director, faculty, and residents were collected. The institutional review board granted a waiver for this study, and all subjects provided informed consent.

Results. Of the 84 program directors who responded, 9 (10.7%) were chaired by females and 75 (89.3%) by males; residency program director positions were held by 36 (42.9%) females and 48 (57.1%) males. More programs were located in the northeastern United States ($n = 31$, 36.9%) than in any other region, and more were self-described as academic ($n = 36$, 42.9%) than any other practice type. Programs that were led by a male chairperson had a similar proportion of female faculty (25.2% versus 27.3%; $P = .322$) and residents (26.2% versus 27.4%; $P = .065$) compared with those led by a female. Similarly, radiology departments with a male residency program director had a similar proportion of female residents (24.8% versus 28.7%; $P = .055$) compared with programs with a female residency program director.

Conclusion. The gender composition of radiology faculty and residents does not differ significantly according to the gender of the departmental chairperson or residency program director. Nevertheless, there continues to be a disparity in the representation of women among radiology faculty and residents.

Key Words. Radiology; gender; female faculty; female residents; chairperson; residency program director.

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The number of women in medicine and, in particular, academic medicine (1, 2) has been steadily increasing over the past several decades (3, 4). This has been particularly true in the field of radiology. Deitch et al. (5) reported a significant rise in the proportion of female graduates in radiology: 27% of graduates between 1990 and 1995 were women compared with 7% before 1970. More recently, however, results from a 2003 American College of Radiology survey indicated that only 24% of radiology trainees and 18% of practicing radiologists were women (6). Despite increases in the representation of women until the mid-1990s, the proportion of female residents and faculty, especially in tenured and chairperson positions (7), continues to lag behind that of men.

Several studies have demonstrated that, compared with male colleagues, women in medicine receive lower salaries (8–10), are promoted less rapidly (8, 9, 11), and less frequently hold the rank of full professor in their departments (2, 4, 11–14). It is possible that the proportion of women in medicine is influenced, in part, by the gender composition of the departmental leadership. In 2006, only 10% of academic departments across all medical specialties were led by women (15). In a recent study of academic emergency medicine departments, it was demonstrated that a department led by a female chairperson was more likely to have a female residency program director (RPD) and a greater proportion of female faculty (16), suggesting that gender of departmental leadership has a significant effect on the gender of faculty and young trainees. Nevertheless, it remains uncertain whether the gender of radiology department chairperson and/or RPD is associated with the gender composition of faculty and housestaff.

We performed a prospective, Web-based survey of all 188 RPDs of Accreditation Council for Graduate Medical Education (ACGME)-accredited radiology training programs. The purpose of our study was to examine the gender of the chairperson, RPD, faculty, and housestaff of radiology training programs in the United States. In addition, we explored whether there was any difference between the gender composition of radiology faculty and residents based on that of the departmental leadership (i.e., chairperson and RPD).

MATERIALS AND METHODS

Study Population

We administered a brief anonymous, Web-based survey to all 188 RPDs of ACGME-accredited radiology residency programs listed in the Fellowship and Residency Electronic Interactive Database (FREIDA Online) of the American Medical Association (AMA) (17). No programs were excluded in this study. Using FREIDA Online, we developed a database of e-mail addresses, first names, and last names of RPDs of all ACGME-accredited radiology programs. In instances where the e-mail address of the RPD was not listed, we collected the listed address for the “person to contact for more information” of the residency program, which was also listed at the same site. This information was collected from the FREIDA Online database on December 31, 2006.

Survey Administration

We used DADOS-Survey (18), an open-source Web-based survey software application developed at our institution by three of the co-authors to administer surveys in this study. The development, design, technical characteristics, and usability testing of this application have been previously described (18). Briefly, DADOS-Survey was designed to promote compliance with the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (19). Similar to CONSORT for randomized controlled trials and QUORUM for meta-analyses, the CHERRIES guidelines outline recommendations for reporting results from Web-based surveys.

This study was reviewed and granted a waiver by the institutional review board at our institution. The survey was developed to provide a snapshot of gender characteristics of radiology programs at the time of the survey. The survey questions are listed in Table 1. The name and e-mail address of each survey recipient were known to the investigators at the time of survey administration in order to determine the target cohort; however, this was discarded at the onset of the survey and no identifying information was collected at any point during survey administration to ensure anonymity for participants. Because this was an anonymous survey, no cookies were used to assign unique identifiers to computers, nor was an IP (Internet Protocol) address check implemented to prevent potential duplicate entries from the same computer.

Prior to administration, the usability and technical functionality of the final survey were verified to be in accordance with established benchmarks for DADOS-Survey (18). We used a voluntary, open survey design (no login or password required) in which recipients were able to anonymously access the survey by following the URL (Uniform Resource Locator) link contained within an introductory e-mail; the URL was the same for all recipients. In this e-mail, survey recipients were informed of the purpose of the study and name, institution, and e-mail address of the principal investigator. There was no other advertisement of the survey and no incentives were offered. The survey was sent in three identical waves, each 14 days apart, beginning January 3, 2007. In each wave, the survey was re-sent to all potential participants to ensure anonymity to the investigators, who were unaware as to the identity of respondents in a given wave. Upon clicking the URL, participants were taken directly to the Website containing the survey, without being shown any other Web content. As the survey was limited to eight questions on one page, there was no randomiza-

Table 1
Responses to Survey Questions

Variable	Frequency (Percentage)
Region	
Midwest	20/84 (23.8%)
Northeast	31/84 (36.9%)
South	21/84 (25%)
West	12/84 (14.3%)
Description of radiology program	
Academic	36/84 (42.9%)
University-affiliated	26/84 (31.0%)
Community	17/84 (20.1%)
Military	1/84 (1.2%)
Other	4/84 (4.8%)
Gender of the radiology department chairperson	
Female	9/84 (10.7%)
Male	75/84 (89.3%)
Gender of the radiology residency program director	
Female	36/84 (42.9%)
Male	48/84 (57.1%)
No. of total faculty members in your radiology department*	
n = 3100; mean = 36 ± 25	
0–22	30/83 (36.1%)
23–36	25/83 (30.1%)
37–150	28/83 (33.8%)
No. of female faculty members in your radiology department*	
n = 791; mean = 9 ± 8	
0–5	33/83 (39.8%)
6–10	25/83 (30.2%)
11–46	25/83 (30.2%)
Total No. of residents in your radiology housestaff (excluding fellows)*†	
n = 2083; mean = 25 ± 13	
0–17	29/84 (34.5%)
18–30	26/84 (31%)
31–60	29/84 (34.5%)
No. of female residents in your radiology housestaff (excluding fellows)*	
n = 550; mean = 9 ± 8	
0–4	30/84 (35.7%)
5–7	29/84 (34.5%)
8–26	25/84 (29.8%)

*Survey participants were only able to provide a free-text numerical response regarding the number of total and female faculty and residents in their program. The totals for all programs that responded and mean ± standard deviation are depicted, along with categories designed after the completion of the study to demonstrate the distribution of these values.

†The most recent data from the ACGME indicate there were 4134 diagnostic radiology residents on duty in July 2004 (25).

tion of the presentation of survey questions, nor was adaptive questioning used. At the completion of the survey, a completeness check for unanswered questions was performed using JavaScript by DADOS-Survey. Due to the brevity of the survey, no review step or timestamp was implemented in this study. All collected survey responses were automatically captured by DADOS-Survey, encrypted, and stored on a password-protected server.

Statistical Analysis

All data were tabulated using Microsoft Excel (Microsoft Corporation, Redmond, WA) and analyzed using Intercooled Stata 10 (Stata Corporation, College Station, TX) and GNU-R (<http://www.r-project.org/>, last accessed March 20, 2007). Due to the possibility of large variation (i.e., large standard deviations) in the number of faculty and residents between programs, gender proportions were calculated in order to perform comparisons. Gender proportions were compared according to departmental leadership gender using a two-tailed binomial proportions test. All tests were performed using 95% confidence intervals. $P < .050$ was considered statistically significant.

RESULTS

The survey was sent to a total of 188 residency program directors. The survey was accessed 153 times, and 84 surveys were completed and submitted. Each response contained a unique set of values. One survey respondent did not answer the two questions regarding faculty size; otherwise, there were no incomplete surveys. The mean time needed to complete the survey was just under 4 minutes (236 seconds). Of the 84 programs, 10.7% (9 of 84) were chaired by females and 89.3% (75 of 84) by males; RPD positions were held by 42.9% (36 of 84) females and 57.1% (48 of 84) males.

The survey questions and responses are listed in Table 1. More programs were located in the northeastern United States ($n = 31$, 36.9%) than any other region and more were self-described as academic ($n = 36$, 42.9%) than any other practice type. There was an average of 36 ± 25 total faculty in all programs, with 9 ± 8 female faculty. On average, there were 9 ± 8 female residents in each program, with a mean total resident size of 25 ± 13 . Results of the bivariate analysis are depicted in Table 2. Programs which were led by a male chairperson had a similar proportion of female faculty (25.2% versus 27.3%; $P = .322$) and residents (26.2% versus 27.4%; $P = .065$)

Table 2
Association of chairperson and residency program director gender with that of faculty and housestaff

	Association Between Gender of the Radiology Department Chairperson and Outcomes			Association Between Gender of the Radiology Residency Program Director and Outcomes		
	Female	Male	<i>P</i> value	Female	Male	<i>P</i> value
Female faculty members	143/524 (27.3%)	648/2576 (25.3%)	.322	371/1397 (26.6%)	420/1703 (24.7%)	.230
Female residents	96/350 (27.4%)	454/1733 (26.2%)	.065	245/854 (28.7%)	305/1229 (24.8%)	.055

compared with those led by a female. Similarly, radiology departments with a male RPD had a similar proportion of female residents (24.8% versus 28.7%; $P = .055$) compared with programs with a female RPD. There was no difference in gender composition in the following subgroup analyses: according to self-description (e.g., academic); program size according to total number of faculty or residents (<20 versus ≥ 20 ; <30 versus ≥ 30); or by region. In addition, there was no association between chairperson gender and the RPD gender.

DISCUSSION

We received 84 responses to this prospective, Web-based survey of RPDs of ACGME-accredited radiology training programs. Our results demonstrate no statistical difference in the gender composition of faculty or residents between programs that are led by a male chairperson compared with those led by a female. Similarly, there was no difference in the gender composition of residents among programs with a male RPD compared with those with a female RPD. It should be noted, however, that there might, in fact, be a trend associated with this comparison that failed to reach statistical significance ($P = .055$) because of the relatively small number of survey responses. Nevertheless, our results demonstrate a lower representation of female radiology faculty (mean 24%) and housestaff (26%) among programs who responded. This underrepresentation is particularly marked at the chairperson position, as nearly 11% of responding programs were led by women. Interestingly, women more equally held the position of RPD (43% compared with 57% males), nearly twice as much as their proportion on the faculty.

The number of women entering medical school has steadily increased over the years, with females comprising 49% of medical students in 2005–2006 (15). It is encouraging that the number of women in medical school con-

tinues to increase, nearly reaching parity with male students. However, a closer examination of data from the Association of American Medical Colleges (AAMC) during the same period demonstrates a "telescoping effect" in academic medicine: females comprised 42% of residency and fellowship positions, 32% of faculty positions (16% of full professorships), 10% of department chairs, and only 11% of medical school decanal positions (15). There are several plausible reasons for the relative paucity of women in senior positions; however, most of the evidence draws from individual medical specialties. A study of academic pediatrics departments found that, compared to men, the lower ranks and salaries of female faculty were due, in part, to imbalances in academic output (e.g., publications), and time allocated to clinical and teaching activities (1). Recently, a survey of academic chairpersons found that many of the department leaders recognized obstacles for female faculty, citing insufficient mentorship as a significant source of disparity (20). It is unknown whether these disparities exist for women in radiology. Nonetheless, the proportion of women achieving senior rank in academic departments lags behind male colleagues. A 1997 survey of academic radiologists demonstrated that, among full professors, only 55% of women were tenured compared with 73% of men (7). These differences could result from disparate support for research: consideration for promotion is frequently based on publication track record (7, 21). Interestingly, in the same survey, a significantly greater percentage of male respondents reported receiving grant support compared with females (7).

As with other specialties, gender inequalities continue to exist in the radiology. Between 1970 and 1995, the percentage of female graduates from radiology residency training increased from 7% to 27.0% (5, 22). Despite these advances, women continue to be a minority among radiology housestaff, with relatively unchanged increases in representation over the past ten years: women com-

prised 27.4% of housestaff in 2005 compared with 27.0% in 1995 (4). Similarly, in our sample, women comprised only 26% of housestaff. During the same interval, however, the number of women graduating from U.S. medical schools increased nearly 10% (4). It is unclear why the number of females entering radiology has not increased in proportion to the number graduating from medical school. Several reasons have been suggested, including gender discrimination and medical students' perception that there are relatively few female role models in radiology (23). As a radiology clerkship is not required at most medical schools, it is possible that students who choose to pursue radiology residency do so based on their elective experience and limited perceptions of the field, which are likely influenced, to a large extent, by the faculty and resident mentors they encounter during their time in school. There currently exists a dearth of evidence pointing to an explanation for the relatively low proportion of female medical students pursuing radiology. To the best of our knowledge, data regarding the number and proportion of female applicants to radiology are not publicly available from the AAMC or its divisions; careful examination of these data would better explain whether there is a bottleneck at the level of medical school. However, there is little evidence to suggest discrimination in the selection of residents. In fact, a 2005 study of Canadian radiology residency applicants found that men and women were not selected for radiology programs at comparable rates (22). While it remains uncertain why the proportion of females comprising radiology residency programs appears to have plateaued compared with that of graduating medical students, the current proportion of female residents is consistent with the 25% of women comprising academic radiology faculty in 2006 (4) and 24% of female faculty in this study. One approach to decreasing this gender disparity would be to increase students' exposure to radiology during medical school. With the increasing utilization of diagnostic imaging in modern medicine, it is essential that all medical students become familiar with different imaging modalities and their indications. By requiring a structured radiology course during the core clerkship curriculum, students will be better trained in basic image interpretation and the management of their patients. An emphasis should be made on exposing students to the relationship between radiology subspecialties (e.g., mammography, pediatrics, neuroradiology) and medical specialties that have traditionally attracted relatively higher proportions of women (gynecology, pediatrics, neurology) (4). Such exposure to radiology would not only enhance one's training, but also

increase the likelihood of identifying career mentors among the faculty and residents much earlier in one's medical training, compared with during fourth-year elective time when the decision for residency selection is looming.

Although a recent study of emergency medicine departments demonstrated a higher proportion of female faculty when the chairperson was of the same gender (16), we found no such association in radiology. In the study by Cheng et al. (16), women comprised a minority of RPD positions (20 of 133, or 15%). Although the authors did not collect data regarding residents, it is possible that the lower proportion of female RPDs in emergency medicine compared with radiology contributes, in part, to gender differences further "downstream" at the faculty level. Of note, women comprised nearly 43% of RPD positions among programs who responded to our survey of radiology programs, suggesting not only greater parity at one key departmental leadership position, but possibly one reason for the apparent lack of gender differences among faculty and residents according to the gender of departmental leadership. Further data are needed to explore why the representation of women as RPDs is greater than the faculty as a whole.

One of the primary limitations of this study was the anonymous, open survey design. Participants were able to complete the survey anonymously to ensure their privacy; a login or password, which would potentially identify respondents and the gender characteristics of their particular program, was not required. As such, participants could theoretically have submitted more than one set of responses to the survey. For this reason, view, participation, and completion rates were not able to be assessed. As only 84 program directors completed the survey, the responses are representative only of the programs that responded. [Of note, this was the same number of responses to the most recent (2006) annual survey of the Association of Program Directors in Radiology (APDR) (24)] In order to ensure brevity of the survey, no data regarding gender of subspecialty faculty or fellows were collected. In addition, questions regarding reasons for choosing radiology, perception of gender discrimination, or gender related departmental policies were not asked. It is possible that many women have themselves chosen not to pursue an open leadership (chair or RPD) position. Historical data concerning chair or RPD gender were unavailable from the AAMC, American College of Radiology, or APDR. This would have provided additional insight regarding any gender trends in leadership over the past sev-

eral years. We collected data regarding RPD gender because of their leadership role in the residency program. However, at many institutions, a committee of faculty and residents has a greater role than the RPD alone in the selection of residents, and thus an influence on gender composition. In addition, questions regarding length of tenure in chairperson or RPD positions were not asked, which potentially affect faculty and resident gender.

CONCLUSION

In essence, our survey results demonstrate that the proportion of female radiology faculty and residents did not differ significantly according to the gender of the department chairperson or RPD. Nonetheless, the proportions of female faculty and residents continue to be lower compared with males.

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