Gender Differences in Faculty Rank Among Academic Emergency Physicians in the United States

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ABSTRACT

Background: The purpose of this study was to complete a comprehensive analysis of gender differences in faculty rank among U.S. emergency physicians that reflected all academic emergency physicians.

Methods: We assembled a comprehensive list of academic emergency medicine (EM) physicians with U.S. medical school faculty appointments from Doximity.com linked to detailed information on physician gender, age, years since residency completion, scientific authorship, National Institutes of Health (NIH) research funding, and participation in clinical trials. To estimate gender differences in faculty rank, multivariable logistic regression models were used that adjusted for these factors.

Results: Our study included 3,600 academic physicians (28%, or 1,016, female). Female emergency physicians were younger than their male colleagues (mean [±SD] age was 43.8 [±8.7] years for females and 47.4 [±9.9] years for males [$p < 0.001$]), had fewer years since residency completion (12.4 years vs. 15.6 years, $p < 0.001$), had fewer total and first/last author publications (4.7 vs. 8.6 total publications, $p < 0.001$; 4.3 vs. 7.1 first or last author publications, $p < 0.001$), and were less likely to be principal investigators on NIH grants (1.2% vs. 2.9%, $p = 0.002$) or clinical trials (1.8% vs. 4.4%, $p < 0.001$). In unadjusted analysis, male physicians were more likely than female physicians to hold the rank of associate or full professor versus assistant professor (13.7 percentage point difference, $p < 0.001$), a relationship that persisted after multivariable adjustment (5.5 percentage point difference, $p = 0.001$).

Conclusions: Female academic EM physicians are less likely to hold the rank of associate or full professor compared to male physicians even after detailed adjustment for other factors that may influence faculty rank.

While gender parity in academic medicine has improved since women were first admitted to medical school in 1849, there has been minimal progress over the past decade.[1–4] As few as one-third of medical school faculty are female and female faculty comprise a lower proportion of those who are full professors, have senior authorship, or have National Institutes of Health (NIH) funding.[4] This is an issue in multiple medical specialties and, despite attempts at promoting workforce diversity, includes academic emergency medicine (EM).[5–8]

Recent work has demonstrated that as little as one-third of academic EM physicians are female and these

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physicians face significant disparities in representation and academic rank by gender.[8] However, this important analysis was survey based and of limited size (1,371 full-time faculty, 33% of whom were women) and response rate (47%), raising potential concerns about sample bias and generalizability. To our knowledge, with the exception of previous work using our same data set that identified gender differences in EM full professorship (absolute adjusted gender differences in full professorship were −2.5% (95% confidence interval [CI] = −4.6% to −0.4%) no other published evidence exists on the association between physician gender and faculty rank among a comprehensive set of academic EM physicians with specific adjustment for detailed factors that may be correlated with physician gender and faculty rank. Therefore, we completed a comprehensive analysis of gender differences among U.S. academic emergency physicians, using a previously published approach.[4–6]

METHODS

Data Sources

We obtained physician characteristic data from a comprehensive database of all licensed U.S. physicians maintained by Doximity (www.doximity.com), an online networking service for U.S. physicians. As of November 2014, when we were provided the data, the Doximity database included 1,005,419 physicians across all specialties. Doximity identifies physicians for inclusion in the database using the National Provider Identifier (NPI) Registry. Physicians without active NPI numbers can self-register with Doximity. All physicians with active NPI numbers have accounts with Doximity, which they can register to use for free. Once registered, physicians can update their personal and professional information that Doximity has obtained (described below). As of November 2014, a total of 239,136 of 1,0005,419 physicians in the database (23.8%) were registered with Doximity. However, the database is inclusive of nearly all licensed U.S. physicians (see below).

The Doximity database includes data elements on all physicians, independent of registration status, including age; gender; year of medical school and residency completion; clinical specialty; board certification status; publication number (first, last, and total); number of NIH grants for which the physician was principal investigator (PI); number of clinical trials for which the physician was a PI or subinvestigator; faculty appointment at a U.S. medical school, based on prior linkage with the Association of American Medical Colleges (AAMC) faculty roster database; and faculty rank. Importantly, Doximity's database is not restricted to physician members. Doximity has obtained physician information from several sources, including state licensing boards, the American Board of Medical Specialties, PubMed, ClinicalTrials.gov, NIH RePORT database, and the AAMC faculty roster database and through data sharing partnerships with hospitals and medical schools. Detailed descriptions of the Doximity database and methods used to merge it with these other data sources have been previously published.[4] In addition to these data, we added to this database publicly available information about each physician's 2013 Medicare Claims revenue (publicly available at www.cms.gov) as a proxy for clinical productivity and whether the physician held an academic appointment at a medical school ranked in the top 20 for research by *U.S. News & World Report* in 2013.

Study Population

The study population of interest included all EM physician faculty (assistant, associate, or full professors) in the 2014 AAMC faculty roster, a comprehensive list of faculty affiliated with U.S medical schools in 2014.[9] Thus, we believe that this study was inclusive of all U.S. EM physician faculty in 2014. The human subjects review committee at Harvard Medical School approved this study, waiving participant consent.

Data Validity

In previous research studies, investigators performed manual audits of the profiles of 200 randomly chosen physicians in the Doximity database to confirm faculty rank, publications in PubMed, clinical trial participation, and NIH funding.[4]

Data Analysis

We first evaluated the characteristics of males and females in the study sample using two-sided t-tests and chi-square tests. We then estimated a hierarchical multivariable logistic model of the probability of full professorship as a function of gender, years since residency completion ("tenure"), age, number of publications (first or last author and total), NIH grants (a dichotomous variable of whether a physician was ever a PI on an NIH grant), clinical trial participation (dichotomous), appointment at a top 20 U.S. medical school (dichotomous), and 2013 Medicare claims volume (continuous). This model contained random-effect

parameters for the school in which a physician worked because outcomes could be correlated among physicians within each school. Our primary outcome was the absolute adjusted difference between males and females in the proportion that were full professors. We also reported this outcome as an adjusted percentage of full professorship for males and females.

We also estimated additional multivariable logistic regression models to assess two secondary outcomes: gender differences in associate or full professorship (combined outcome) compared with assistant professorship, and gender differences in full professorship compared with associate professorship (excluding assistant professors). These models included the same covariates as the primary outcome model. Finally, we estimated separate multivariable logistic regression models of grants and clinical trials as a function of physician age, years since residency, employment at top 30 medical school, and total Medicare payments, to analyze whether gender differences were present in grants and clinical trials. Similarly, we estimated multivariable linear regression models of total publications as a function of these covariates, to determine whether there were differences in publications between male and female faculty after adjustment for other covariates. p-values ≤ 0.05 were considered statistically significant. Data analysis was performed using Stata, version 14 (StataCorp).

RESULTS

Among 3,600 academic EM physicians in our analysis, 28% were female (Table 1). Female emergency physicians were younger than their male colleagues (mean [±SD] age 43.8 ± 8.7 years vs. 47.4 ± 9.9 years ± SD, $p < 0.001$). Female emergency physicians were

Table 1
Characteristics of the Study Population

	All (N = 3,600)	Male (n = 2,584)	Female (n = 1,016)	p-value for Difference*
Faculty rank				
Assistant professor	2,511 (69.8)	1,702 (65.9)	809 (79.6)	<0.001
Associate professor	685 (19.0)	537 (20.8)	148 (14.6)	
Full professor	404 (11.2)	345 (13.4)	59 (5.8)	
Top 20 medical school†	818 (23.6)	570 (23.0)	248 (25.3)	0.156
Age (years)‡	46.4 ± 9.7	47.4 ± 9.9	43.8 ± 8.7	<0.001
Age group (years)				
<40	1,009 (29.3)	640 (25.8)	369 (38.4)	<0.001
40–44	710 (20.6)	480 (19.3)	230 (24.0)	
45–49	554 (16.1)	429 (17.3)	125 (13.0)	
50–54	401 (11.6)	297 (12.0)	104 (10.9)	
55–59	350 (10.2)	278 (11.2)	72 (7.5)	
60–64	258 (7.5)	211 (8.5)	47 (4.9)	
≥65	163 (4.7)	149 (6.0)	14 (1.5)	
Years since residency‡	14.7 ± 9.6	15.6 ± 9.8	12.4 ± 8.3	<0.001
No. of publications‡				
Total	7.4 ± 17.2	8.6 ± 18.5	4.7 ± 12.9	<0.001
First or last author	6.3 ± 19.6	7.1 ± 20.3	4.3 ± 17.4	<0.001
NIH grants				
≥1	87 (2.4)	75 (2.9)	12 (1.2)	0.002
Mean No. of grants (25th–75th percentile)	3.4 (1–4)	3.6 (1–4)	1.8 (1–2.5)	0.158
Clinical trials				
≥1	131 (3.6)	113 (4.4)	18 (1.8)	<0.001
Mean no. of trials (25th–75th percentile)	1.5 (1–2)	1.5 (1–2)	1.5 (1)	N/A
Mean total Medicare payments in 2013‡	$43,590 ± $35,470	$45,670 ± $38,640	$37,890 ± $23,900	0.08

Unless otherwise indicated, data are reported as number (%) of emergency physicians.
*p-values reflect two-sided t tests and chi-square comparisons where appropriate
†Top 20 school signifies whether an emergency physician was on faculty at a medical school ranked in the top 20 for research *by U.S. News & World Report* in 2013.
‡Data are reported as mean ± SD.

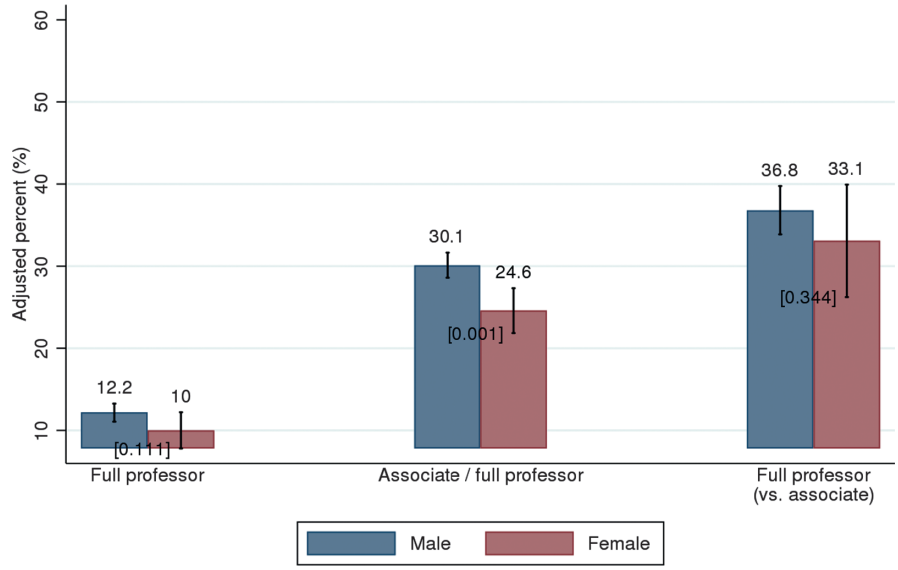

Figure 1. This graph shows adjusted difference in faculty rank between male and female academic EM physicians. Male and female faculty ranks compared were full professorship (compared with assistant or associate professorship), associate or full professorship (compared with assistant professorship), and full professorship (compared only to associate professorship). p-values for comparisons in brackets. Adjusted for publications, grants, clinical trials, age, years since residency, medical school ranking, and total Medicare payments.

more likely to be assistant professors (79.6% vs. 65.9% $p < 0.001$), had fewer years since residency completion (mean = 12.4 years vs. 15.6 years, $p < 0.001$), had fewer total publications (mean = 4.7 vs. 8.6, $p < 0.001$) or first or last author publications (mean = 4.3 vs. 7.1, $p < 0.001$), and were less likely to have NIH grants (1.2% vs. 2.9%, $p = 0.002$) or clinical trials (1.8% vs. 4.4%, $p < 0.001$) compared to their male colleagues. However, female and male emergency physicians had similar probabilities of being on faculty at a top 20 medical school (Table 1).

Adjusting for age, years since residency, top 20 medical school ranking, and total Medicare payments, there were no significant gender differences regarding number of clinical trials, NIH grants, total number of publications, or first or last author publications (data not shown). However, after adjustment for age, years since residency, publications, grants, clinical trials, medical school ranking, and total Medicare payments, males had a higher probability of being an associate or full professor versus an assistant professor compared to females (adjusted percentage for males 30.1% vs females 24.6%, adjusted difference 5.5% [95% CI = 2.4% to 8.7%], $p = 0.001$ for difference); with the same adjustment, the comparison of females to males with regard to full professor versus assistant or associate professor approached significance (adjusted percentage for males 12.2% vs females 10.0%, adjusted difference 2.2% [95% CI = –0.3% to 4.7%], $p = 0.11$ for difference; Figure 1).

DISCUSSION

In a comprehensive physician database, we found that female physicians comprise only 28% of the academic EM workforce. This is slightly lower than previously reported values of 31% to 33%.[8] Prior data were from a 2010 survey of a limited subset of 1,372 full-time academic emergency physician faculty.

Our analyses demonstrated many gender discrepancies among academic EM physicians in both unadjusted and adjusted analyses. Females were younger and had fewer years since residency completion. Most significantly, female emergency physicians were less likely to be associate or full professors when compared to their male colleagues even after adjustment for detailed factors that are vary across male and female physicians and that may be associated with academic advancement. Our findings are similar to prior publications for EM as well as across other medical specialties.[4,8]

Prior data across physician specialties demonstrate that only 22% of full professors are female and this percentage is lower in EM, where only 17% of full professors are female.[9] The disparities in academic advancement observed in our study may also contribute to numerous other gender disparities in EM including differences in compensation, grant funding, administrative roles, and leadership positions. It is unclear what proportion the lack of retention versus the lack of advancement contribute to the lack of female faculty at higher ranks.

Our findings also relate to other important facts on gender differences in academic EM. There is a lower percentage of female EM residents compared to many other specialties as well as U.S. resident physicians overall.[1] Moreover, while many surgical subspecialties have seen increases in female residents over the past decade, EM has not (36% in 2005 vs. 37% in 2015).[1] The lack of recruitment and retention of female EM trainees may significantly affect numbers of female academic faculty. Future efforts to increase female faculty should include targeted strategies for the recruitment and retention of female residents.

LIMITATIONS

This study has several limitations. First, although Doximity is one of the most extensive physician databases available, inaccuracies are possible. However, these data have been validated in multiple previous large-scale studies.[4–6] Moreover, it is not clear why inaccuracies should be systematically associated with physician gender. Second, this was a cross-sectional study and cannot assess rates of academic promotion over time. Third, it was also beyond the scope of this analysis to identify the relative impact of some modifiable factors (e.g., the impact of maternity leave or type of faculty track) or nonmodifiable factors (age, given that female emergency physicians were younger than their male counterparts) in the differences identified. Fourth, information on where a physician trained and other factors that may affect academic advancement (such as committee participation, leadership roles within an institution, other awards, etc.) were not available. Fifth, our analysis focused on adjusted differences in professorship between male and female physicians. It is possible that gender differences may exist in access to mentorship; resource support; and research opportunities that may lead to fewer clinical trials, grants, and publications among female faculty. Adjustment for these factors may therefore bias downward any gender differences in academic advancement since these factors may not only be affected by gender disparities in academic treatment but also affect rates of academic advancement.

CONCLUSIONS

In both unadjusted and adjusted analysis, gender differences in academic advancement exist among U.S. academic emergency physicians. As such, there remains an obvious unmet need for the field of emergency medicine to encourage and promote equal advancement across gender.[9,10] To promote diversity, inclusion and equality in academic emergency medicine, further research and intensified efforts are needed and may benefit from examining the successes of other specialties with fewer academic inequalities between female and male physicians.

References

1. Table 2: Distribution of Residents by Specialty, 2005 Compared to 2015. American Association of Medical Colleges (AAMC). Available at: https://www.aamc.org/download/481180/data/2015table2.pdf. Accessed September 15, 2018.
2. Fang D, Moy E, Colburn L, Hurley J. Racial and ethnic disparities in faculty promotion in academic medicine. JAMA 2000;284:1085–92.
3. Parker RB, Stack SJ, Schneider SM; ACEP Diversity Summit 2016 Attendees. Why diversity and inclusion are critical to the American College of Emergency Physicians' future success. Ann Emerg Med 2017;69:714–7.
4. Jena AB, Khullar D, Olenski AR, Blumenthal DM. Sex differences in academic rank in U.S. medical schools in 2014. JAMA 2015;314:1149–58.
5. Blumenthal DM, Olenski AR, Yeh RW, et al. Sex differences in faculty rank among academic cardiologists in the United States. Circulation 2017;135:506–17.
6. Kapoor N, Blumenthal DM, Smith SE, Ip IK, Khorsani R. Gender differences in academic rank of radiologists in U.S. medical schools. Radiology 2017;283:140–7.
7. Kuhn GJ, Abbuhl SB, Clem KJ; Society for Academic Emergency Medicine (SAEM) Taskforce for Women in Academic Emergency Medicine. Recommendations from the Society for Academic Emergency Medicine (SAEM) Taskforce on Women in Academic Emergency Medicine. Acad Emerg Med 2008;15:762–7.
8. Madsen TE, Linden JA, Rounds K, et al. Current status of gender and racial/ethnic disparities among academic emergency medicine physicians. Acad Emerg Med 2017;24:1182–92.
9. Association of American Medical Colleges (AAMC). U.S. Medical School Faculty, 2015. Available at: https://www.aamc.org/download/453400/data/15table13.pdf. Accessed January 24, 2019.
10. Choo EK, Kass D, Westergaard M, et al. The development of best practice recommendations to support the hiring, recruitment, and advancement of women physicians in emergency medicine. Acad Emerg Med 2016;23:1203–9.