Gender Differences in Retention and Promotion Among Generalists Who Graduated From Research-Intensive Fellowships

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ABSTRACT

Background Generalists who pursue research-intensive fellowships develop research skills and mentor-mentee relationships. Whether gender disparities in retention and promotion exist among this research-trained cohort is understudied.

Objective We measured whether disparities exist among graduates of research-intensive fellowships and how mentorship influences them.

Methods We surveyed generalists (internal medicine, pediatrics, family medicine, combined internal medicine–pediatrics) between July and August 2016 who graduated from research-intensive fellowships. Generalists ("mentees") were asked whether they remained or were promoted, and to name up to 10 influential mentors during or within 5 years of fellowship. Multivariable logistic regression estimated associations between mentee gender and retention and promotion. Next, we separately included 3 network characteristics: (1) mentee degrees (number of mentors reported per mentee); (2) mean mentor betweenness centrality (importance of each mentor within the network); and (3) largest community membership (mentee status in the largest interconnected mentor-mentee group within the network). All models adjusted for generalists' race, specialty, fellowship institution, and publications.

Results One hundred sixty-two graduates (51%) representing 19 institutions responded. In adjusted analyses, compared to men, women were as likely to remain in academic medicine (odds ratio [OR] 1.88; 95% confidence interval [CI] 0.72–4.89; $P = .20$), but less likely to be promoted within 5 years of fellowship (OR 0.26; 95% CI 0.09–0.80; $P = .018$). Inclusion of network measures did not alter these associations.

Conclusions Despite remaining in academic medicine as frequently as their male counterparts, fellowship-trained women were promoted less often. Features of mentors, measured using network analysis, may not explain these observed differences.

Introduction

Women remain in academic medicine less frequently and are promoted less often than men.[1–5] Based on a national survey of US academic faculty members from multiple specialties, women were 32% less likely to stay in academic medicine and 43% less likely to be promoted even after adjusting for seniority, marital status, parental status, and professional time distribution (ie, how time is allocated for clinical, administrative, and research duties).[5] Yet, it is unknown whether fellowship-trained academic generalists who complete specialized, academic career–oriented training experience the same disparities.

Generalists committed to academic medicine often pursue research-intensive fellowships (eg, general medicine, general pediatrics, health services, or the Robert Wood Johnson Foundation Clinical Scholars Program) to prepare themselves for academic careers. Such fellowship programs can be important launching pads for academic physicians,[6] imparting research competencies and opportunities to work on peer-reviewed publications, which are strongly associated with early career retention and advancement.[5,7]

Research-intensive fellowships also connect fellows with mentors in the academic research community, either by preassigning mentors or by strong mentor-mentee relationships fostered by fellowship directors. Mentorship fostered during early career development is believed to significantly impact future productivity, promotion, retention, and subsequent career success.[4,8–10] Moreover, while certain mentor characteristics (eg, sphere of influence or connectors for mentees to other mentors) have been described,[11–13] there is little empirical evidence exploring which mentorship characteristics influence whether mentees remain or are promoted in academic medicine, or how those influences differ by gender. If men and women develop differential quantity and quality of mentors, differential rates of retention and promotion may be observed. For example, women may not have, or are denied, the same opportunities as men to build

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Editor's Note: The online version of this article contains the survey distributed to graduates of research-intensive fellowships.

relationships with key mentors who are better at successfully coaching mentees, or lack mentors who sponsor mentees by nominating them for national committees or to present at important meetings.[14] These mentorship relationships can enhance mentees' publication productivity, create leadership opportunities, and improve their likelihood to be promoted.

Fellowship-trained generalists represent a much more homogenous population with respect to career differentiation, skill attainment, and mentorship environment than broad populations studied in prior literature. Observing disparities in retention and promotion among this understudied cohort of academic generalists may raise concerns that disparities persist despite similar career interests or research training experiences. Our study sought to determine whether gender disparities in retention and promotion existed in a cohort of generalist physicians who completed research fellowships. We also assessed whether features of mentorship, measured using network analysis of a 6-year cohort of mentors and mentees, were associated with gender differences in retention and promotion.

What was known and gap
Women are less likely than men to stay in academic medicine after training, and those who do are less likely than men to be promoted. It is unknown if fellowship-trained academic generalists who complete specialized, academic career–oriented training experience the same disparities.

What is new
A survey about career advancement and mentorship relationships were asked to a variety of generalists who completed research-intensive fellowship training.

Limitations
Survey did not capture all characteristics that may be important to promotion over time, and only included data within 5 years posttraining.

Bottom line
Despite remaining in academic medicine, fellowship-trained women were promoted less often. The quality and features of mentorship may not explain these observed differences.

Methods

Study Sample

We identified a sample of allopathic and osteopathic physicians trained as generalists (internal medicine, pediatrics, family medicine, or combined internal medicine–pediatrics) who completed research-intensive fellowships in the United States between 2002 and 2007. To maintain a cohort with similar professional trajectories, we excluded individuals with clinical subspecialty training (eg, cardiology and nephrology).

Between January and May 2016, we used information from websites for the US Health Resources and Services Administration T32 training program, the Robert Wood Johnson Foundation Clinical Scholars Program, and professional societies (Society of General Internal Medicine, American Academy of Pediatrics, and American Academy of Family Physicians) to aggregate a list of research-oriented fellowships with fellows who graduated between 2002 and 2007. To capture programs not listed through these sources, we conducted additional, independent web-based searches for eligible fellowships using the following terms: *general internal medicine fellowship*, *general pediatrics fellowship*, *primary care fellowship*, and *family medicine fellowship*.

From this list, we created a database of eligible generalists and obtained their e-mail addresses through a search of publicly available information and requests to fellowship program leaders. We retained all available e-mail addresses to maximize our chances of reaching individuals with multiple addresses and updated contact information during the survey period for graduates who had automated messages noting their most current e-mail addresses.

Survey Design and Procedures

Prior to administering the survey, we conducted cognitive testing of the survey to ensure that respondents would understand the meaning of the questions and could answer the questions appropriately. Cognitive testing was conducted with fellows and faculty members at the University of Pennsylvania, including 10 fellows who were generalists undergoing research-intensive fellowships at the time and 7 academic faculty members who were generalists and graduates of research-intensive fellowships. In addition, we reviewed the survey with an expert in psychometrics and survey design (J.A.S.) prior to recruiting participants nationally.

Between July and August 2016, we invited eligible generalists to participate in an e-mail survey hosted using REDCap.[15] The survey (provided as online supplemental material) collected self-reported demographic information (gender, race/ethnicity) as well as fellowship graduation year and institution. Participants were also asked to name up to 10 mentors who they felt were influential during or up to 5 years after their research-intensive fellowship. To maximize our response rate, 2 e-mail reminders were sent, and respondents were entered into a raffle for 1 of 23 Amazon gift cards ($10–$500).

Retention and Promotion Measures

Retention was evaluated via a question about the position(s) held at the 5-year mark after completing

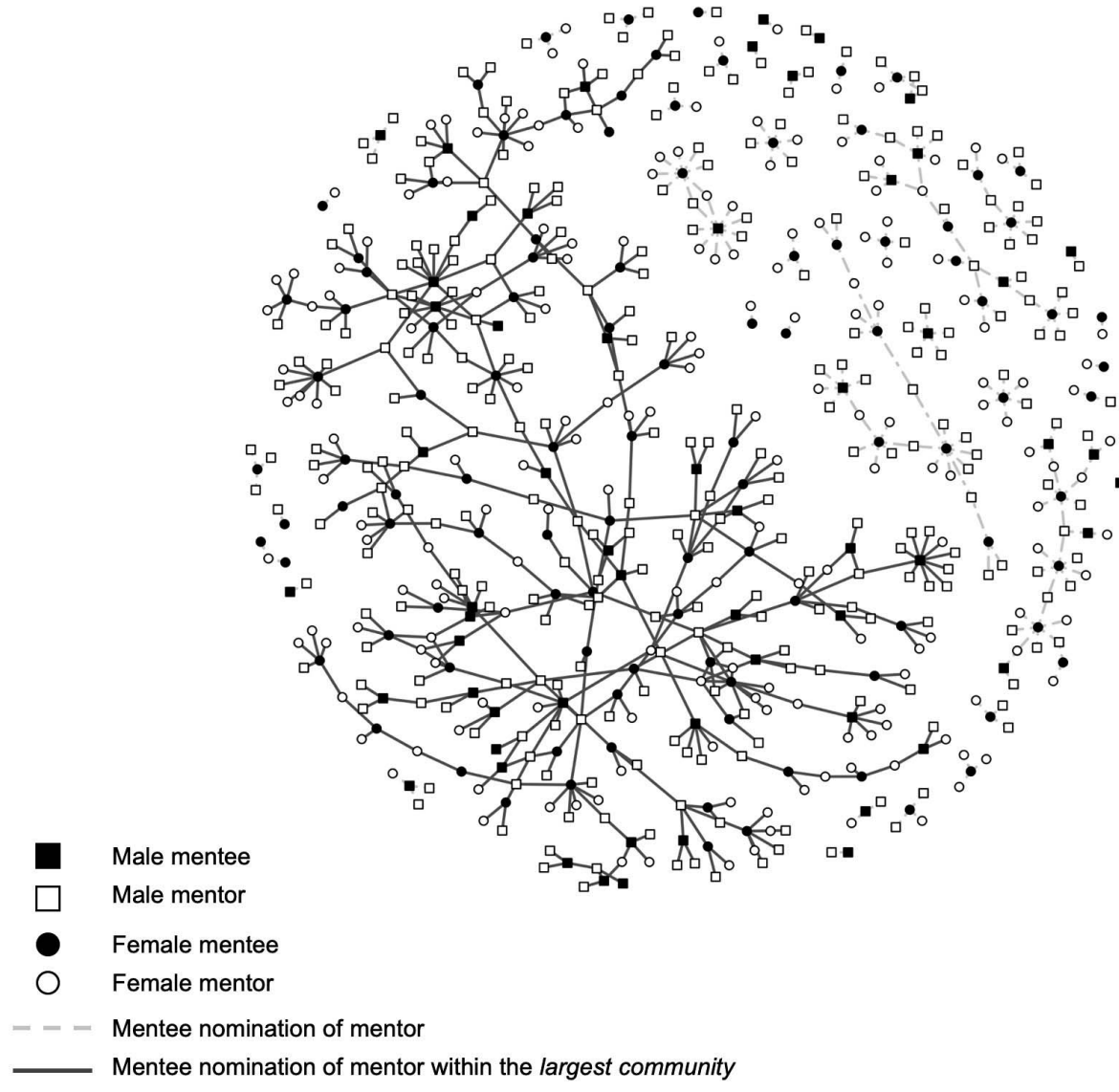

FIGURE
Network Graph of Mentor-Mentee Community

fellowship. Respondents could define their current position as "clinician investigator" or "clinician-educator" alone or in conjunction with other positions. To determine promotion, they were also asked the highest academic rank achieved 5 years after completing their research-intensive fellowship, with answer choices ranging from "clinical instructor" to "full professor." Promotion was defined as achieving the rank of associate professor or higher.

Mentor-Mentee Network Measures

We constructed a bipartite mentor-mentee network (FIGURE) using mentee nominations to define links, and calculated 3 network characteristics: (1) mentee degrees, quantifying the total number of mentors per mentee; (2) mean mentor betweenness centrality,[16] quantifying the importance of each mentor based on the proportion of linkages among network members for which the shortest went through that mentor (larger numbers indicate greater mentor importance); and (3) largest community membership, identifying mentees who belonged to the largest community of mentees and mentors within the greater network formed.

Other Measures

We extracted the number of total and first author peer-reviewed publications from PubMed that were published during and up to 5 years after completion of each respondent's research-intensive fellowship.

TABLE 1
Characteristics of Men and Women Who Completed Research-Intensive Fellowships Between 2002 and 2007

Characteristics	Women (n = 104)	Men (n = 58)	*P* Value
Underrepresented minority, n (%)	11 (11)	5 (9)	.69
Fellowship at Top 25 institution,[a] n (%)	87 (84)	49 (84)	.89
Specialty, n (%)			.12
Internal medicine	54 (52)	41 (71)	
Pediatrics	31 (30)	12 (21)	
Family medicine	17 (17)	5 (9)	
Medicine-pediatrics	1 (1)	0 (0)	
Total publications,[b] mean (SD)	10.3 (8.2)	15.8 (15.1)	< .003
Total first author publications,[b] mean (SD)	5.8 (4.6)	7.8 (6.4)	.022
Mentee degrees,[c] mean (SD)	4.0 (0.2)	3.6 (2.2)	.25
Betweenness centrality of the mentor,[d] mean (SD)	6.7 (1.2)	7.4 (1.7)	.74
Largest community membership,[e] n (%)	62 (60)	36 (62)	.76
Attaining associate professor or higher,[b] n (%)	8 (8)	11 (19)	.033
Retention in academia,[b] n (%)	89 (86)	47 (81)	.45

[a] Top 25 institution designation is based on 2016 *US News & World Report* rankings of research institutions.
[b] Data points are based on the time frame of during or within 5 years of graduating from a research-intensive fellowship.
[c] Definition: Total number of mentors identified.
[d] Definition: Importance of the mentors.
[e] Definition: Mentees who belong within the largest community of mentors and mentees.

We also conducted searches using alternative names when provided by respondents in the survey. We did not distinguish between article types (eg, research articles, brief reports, or perspectives).

The study protocol was determined to be exempt by the University of Pennsylvania Institutional Review Board.

Statistical Analysis

To compare participant demographics and responses, we used a *t* test for continuous variables and chi-square and Fisher's exact tests for categorical variables. For our primary model (model 1), we used mentee-level multivariable logistic regression to estimate the association between the female gender of the mentee and the odds of retention and promotion within 5 years of completing a research-intensive fellowship. We added each of the 3 network measures separately to model 1 to evaluate the association between female gender and our outcomes of interest (retention and promotion), adjusting for mentee degrees (model 2), mean mentor betweenness centrality (model 3), and largest community membership (model 4). In all models, we adjusted for underrepresented minority status, clinical specialty, fellowship training institution ranking (a binary variable indicating if the training site was at a top 25 research institution based on 2016 *US News & World Report* rankings[17]), and total number of publications, consistent with contemporary studies estimating gender differences in retention and promotion.[4,5,18–22] Statistical significance was evaluated at a 2-sided alpha of 0.05. Network measures were calculated in R version 3.2, and statistical analyses were conducted in Stata 14.0 (StataCorp LLC, College Station, TX).

Results

In total, 162 generalists from 19 fellowship programs completed our survey (51%).[23] The majority were women (64%, 104 of 162). Men and women did not differ with respect to demographics, completing a fellowship at a top 25 institution, or specialty (TABLE 1). Men had more total publications (15.8 versus 10.3, $P < .003$) and first-author publications (7.8 versus 5.8, $P = .022$) than women. Women and men had similar mentee degrees, mentor mean betweenness centrality, and proportion of largest community membership. Five years after completing fellowship, retention was similar between women and men (86% versus 81%, $P = .45$), while fewer women had achieved promotion (8% versus 19% of men, $P = .033$).

Association Between Gender and Retention or Promotion

In adjusted analyses (TABLE 2), women had similar odds of retention (odds ratio [OR] 1.88; 95% confidence interval [CI] 0.72–4.89; $P = .20$), but lower odds of being promoted (OR 0.26; 95% CI

TABLE 2
Adjusted Association Among Gender, Network Measures, and Retention or Promotion

Tests of Association	Model 1: No Network Measure		Model 2: Add Degree of Mentees		Model 3: Add Mean Mentor Betweenness Centrality		Model 4: Add Largest Community Membership	
	OR (95% CI)[a]	*P* Value	OR (95% CI)[a]	*P* Value	OR (95% CI)[a]	*P* Value	OR (95% CI)[a]	*P* Value
Association with retention								
Female	1.88 (0.72–4.89)	.20	1.85 (0.71–4.85)	.21	1.90 (0.73–4.96)	.19	1.80 (0.69–4.72)	.23
Mentee degrees	. . .	. . .	1.03 (0.81–1.31)	.78	. . .	. . .	. . .	. . .
Mean mentor betweenness centrality	. . .	. . .	. . .	. . .	0.99 (0.95–1.04)	.77	. . .	. . .
Largest community membership	. . .	. . .	. . .	. . .	. . .	. . .	1.53 (0.60–3.99)	.37
Association with promotion								
Female	0.26 (0.09–0.80)	.018	0.26 (0.09–0.80)	.018	0.25 (0.08–0.79)	.018	0.26 (0.09–0.79)	.018
Mentee degrees	. . .	. . .	1.02 (0.98–1.06)	.92	. . .	. . .	. . .	. . .
Mean mentor betweenness centrality	. . .	. . .	. . .	. . .	0.92 (0.84–1.01)	.10	. . .	. . .
Largest community membership	. . .	. . .	. . .	. . .	. . .	. . .	1.15 (0.37–3.53)	.81

Abbreviations: OR, odds ratio; CI, confidence interval.
Note: For our primary model (model 1), we used mentee-level multivariable logistic regression to estimate the association between the female gender of the mentee and the odds of (1) retention and (2) promotion within 5 years of completing their research-intensive fellowship. We added network measures to model 1, separately, to evaluate the association between female gender and retention/promotion after adjusting for the following 3 network measures: mentee degrees (model 2), mean mentor betweenness centrality (model 3), and largest community membership (model 4).
[a] In all models, we adjusted for underrepresented minority status, clinical specialty, fellowship training institution ranking (binary variable indicating if the training site was at a top 25 research institution, based on 2016 *US News & World Report* ranking), and total number of publications.

0.09–0.80; $P = .018$), compared to men. These findings did not change in models that incorporated mentee degrees (model 2), mean mentor betweenness centrality (model 3), or largest community membership (model 4). Additionally, these 3 network measures were not associated with retention or promotion.

Discussion

This study extends previous work attempting to measure and evaluate gender disparities in academic medicine. We demonstrate that even after completing research-intensive fellowships, and adjusting for differences in publication rate, women were as likely as men to remain in academic medicine, but were less likely to be promoted. These findings pose several implications.

Our results reinforce the prevalence of gender disparities documented in academic medicine.[1–5] Demonstrating this in a concentrated group of physicians highly motivated and committed to academic careers provides a vivid example of disparities. While naming the problem is itself insufficient, doing so represents the first step on the path to improving the institutional and cultural barriers that may be limiting the advancement of women. For example, recognition allows academic communities to institute training to address explicit and implicit bias that might contribute to gender disparities in hiring or promotion.[24,25]

Our results contrast with the theory that mentorship networks are major mechanisms for explaining gender disparities. Prior research identified an association between mentor-mentee dynamics and success among careers in the life sciences.[26–28] In health care, measures of centrality within a community of program directors have been associated with promotion.[29] Like our study, however, these health care–focused studies found no differences in network measures by gender. The absence of findings could occur if the mentorship features that determine

promotion are more than the mentor's position within academic networks. For example, mentors can demonstrate generosity by providing mentees with financial and administrative resources (eg, providing access to datasets or analysts) that may be critical determinants of productivity and early career success.[30,31] Mentors can serve as sponsors, enhancing the visibility of the mentee by nominating junior faculty members to serve on national committees or present at important meetings.[14] We did not measure the generosity of mentors or when they sponsored a mentee. Additionally, a deeper understanding of how mentor-mentee relationships formulate or why some mentor-mentee relationships do not develop may be helpful. For example, men and women may choose mentors differentially, based on those who offer career and life advice as opposed to mentors with higher potential for research productivity, sponsorship for leadership positions, or mentors' ability to expand professional networks.[14,32] Alternatively, mentors may be choosing mentees differently based on the mentees' personalities or career aspirations, and these may correlate with gender.

These findings are limited by the cross-sectional nature of our data. While our study extends early knowledge of certain features of positive mentorship relationships[12,13] and the novel approach of using network methods to capture such features, there is little existing empirical evidence about how to best measure these network features. Network measures are complex,[33] and while the measures we selected in our study did not necessarily play a central role in observed disparities, other network analysis–derived measures could. Given our survey methods, our network depended on the response rate and information provided by respondents. We were unable to capture all characteristics that may be important to promotion over time. For example, part-time employment or time dedicated to responsibilities at home, such as caring for young children or aging parents, may compete with time spent publishing papers or in leadership positions.[5,34–36] Perspectives about mentorship may also differ between generalists in our sample and early career physicians in other specialties, highlighting the need for additional work in other physician populations. Had our survey measured retention and promotion within a longer time frame, such as 10 years, our findings may have been impacted. Our survey questions are retrospective and subject to recall bias. We did not distinguish or capture the type of manuscripts published (eg, research articles, brief reports, or perspectives), and differences in article types may differentially impact promotion. However, different promotions committees at different institutions weigh article types and quantity differently depending on the institution and career track of the faculty member.

Discussions surrounding disparities in academic medicine are likely to continue and so will the search for solutions. Understanding the etiologies of disparate career trajectories will be important when constructing solutions. Further work is needed to qualitatively identify unmeasured factors that influence promotion and retention in medicine, and to critically reassess these outcomes for future cohorts of academic generalists.

Conclusions

Gender disparity appears to exist even in a cohort of early career physicians who have made significant investments of time and training to succeed in academic careers. Ensuring parity in the academic medicine community remains elusive.

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