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Disparities by Sex in Promotion to Associate Professor among a National Cohort of Academic Physicians: Causal Mediation Analysis

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Purpose:

Women comprise about half of U.S. medical-school applicants, matriculants, graduates and residents and have been increasingly appointed as full-time academic-medicine faculty since 2009 but remain underrepresented among associate professors and full professors.¹ Recent investigations suggest that historical disparities in promotion continue to persist,² yet, to our knowledge, the effects of potential mediators that explain this disparity have not been reported.

Method:

The Association of American Medical Colleges (AAMC) provided linked, de-identified data for a national cohort of U.S. MD-granting medical-school matriculants in academic years 1993–1994 through 2000–2001. Data were used from the AAMC Student Record System (sex, race/ethnicity, degree program at graduation), Matriculating Student Questionnaire (parent occupation), Graduation Questionnaire (career preference, medical-school research

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Disclaimers: This study used raw data provided by the Association of American Medical Colleges (AAMC), National Board of Medical Examiners (NBME), and National Institutes of Health (NIH). The statistical analyses, interpretation of findings, and views expressed herein are those of the authors and do not necessarily reflect the position or policy of the AAMC, NBME, or NIH, or their respective staff members. The NIH/NIGMS was not involved in the design or conduct of the study; collection, management, analysis, or interpretation of the data; or in the preparation, review, or approval of the manuscript. Any opinions and conclusions expressed herein are those of the authors and do not reflect the views of the NIH/NIGMS

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and authorship, research-intensive medical school), Faculty Roster (faculty track, initial rank [assistant professor vs. instructor], department at initial appointment, research-intensive faculty institution), National Board of Medical Examiners United States Medical Licensing Exam (USMLE) first-attempt Step 1 and Step 2 Clinical Knowledge (CK) scores, and National Institutes of Health Information for Management, Planning, Analysis and Coordination (IMPAC II) grants awarded. Our outcome of interest was promotion to the rank of associate professor. We utilized Cox cause-specific proportional-hazards model to estimate women's hazard of promotion to associate professor. We employed causal mediation analysis using the inverse odds ratio-weighting technique with bootstrapping³ to estimate mediation effects and their 95% confidence intervals (CI), which we represent as the proportion of the total sex disparity in promotion. We report hazard ratios (HR) and percentages, each with respective 95% CI.

Results:

Of 38,752 matriculants appointed to full-time faculty positions, 33,288 (85.9%) had complete data for analysis. Female (vs. male) faculty had lower hazard of promotion to associate professor (HR 0.77 [0.74, 0.80]), controlling for race/ethnicity, parent occupation, and year of appointment as confounders. In single-mediator models, department at initial appointment explained the largest proportion of the total effect of sex on promotion (22.8% [16.1, 31.2]), followed by medical-student research and authorship (10.6% [7.4, 14.8]) and USMLE Step 1 scores (9.1% [6.0, 13.3]). Receipt of federal grants (6.1% [3.2, 9.2]), initial faculty rank (5.2% [2.3, 8.3]), and faculty career preference at graduation (2.4% [0.05, 4.7]) also were significant mediators. Other mediators did not explain a significant proportion of the sex disparity in promotion. A block of all significant mediators explained 43.0% (34.5, 54.8) of the total effect of sex on promotion.

Discussion:

Our investigation found that initial faculty appointment department explained the greatest proportion of the effect of sex on faculty promotion, while commonly cited contributors, such as grants and faculty track at appointment,⁴ contributed much less or not at all to the disparity. Study limitations include the inability to determine whether sex disparities in hazards of promotion exist within or between specific faculty departments. Medical-school research experiences appeared to explain a substantial proportion of the effect of sex on promotion as well, suggesting long-term benefits of these early interventions. Additionally, our model explained only 43% of the total effect of sex on promotion to associate professor, suggesting that unmeasured variables (e.g., publications/presentations, teaching and administrative duties, family-life considerations, discrimination/harassment) would explain a larger proportion of the disparity.⁵

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References:

1. Lautenberger DM, Dandar V. The State of Women in Academic Medicine 2018–2019: Exploring Pathways to Equity. Washington, DC: Association of American Medical Colleges; 2020. https://store.aamc.org/downloadable/download/sample/sample_id/330/. Accessed April 8, 2022.
2. Richter KP, Clark L, Wick JA, et al. Women Physicians and Promotion in Academic Medicine. *New England Journal of Medicine*. 2020;383(22):2148–2157. [PubMed: 33252871]
3. Nguyen QC, Osypuk TL, Schmidt NM, Glymour MM, Tchetgen Tchetgen EJ. Practical Guidance for Conducting Mediation Analysis With Multiple Mediators Using Inverse Odds Ratio Weighting. *American Journal of Epidemiology*. 2015;181(5):349–356. [PubMed: 25693776]
4. Jeffe DB, Yan Y, Andriole DA. Competing Risks Analysis of Promotion and Attrition in Academic Medicine: A National Study of U.S. Medical School Graduates. *Acad Med*. 2019;94(2):227–236. [PubMed: 30188371]
5. Jagsi R, Griffith KA, Jones RD, Stewart A, Ubel PA. Factors Associated With Success of Clinician-Researchers Receiving Career Development Awards From the National Institutes of Health: A Longitudinal Cohort Study. *Acad Med*. 2017;92(10):1429–1439. [PubMed: 28537950]

Significance:

Findings using national-cohort data suggest that faculty department substantially mediated observed sex disparities in promotion. Identifying departmental or specialty-specific problems amenable to intervention might ameliorate disparities in women's promotion to associate professor. Future investigations of promotion disparities should attempt to examine specific departments/specialties to better understand the nature of this mediating effect.