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Trends in Proportion of Women as Authors of Medical Journal Articles, 2008-2018

Women remain underrepresented in academic medicine, especially among senior faculty.[1] We examined trends in women's representation as authors of medical journal articles, one key measure of academic success.[2]

Methods | For 9 medical specialties (pediatrics, radiology, anesthesiology, obstetrics and gynecology, neurology, general medicine, dermatology, psychiatry, and oncology), we identified original research articles published between January 1, 2008, and August 1, 2018, in the 15 journals with the highest impact factor for 2016 (eTable in the Supplement).[3] We also included 4 additional general medical journals (*New England Journal of Medicine, Journal of the American Medical Association, British Medical Journal,* and *The Lancet*). We used validated software (Genderize.io [https://genderize.io]) to predict a gender and the probability of gender for an author's first name and used a threshold of 60% to assign gender as has been implemented in previous work.[4] For more information, see eMethods in the Supplement. Because this study analyzed public data, it was exempt from institutional review board approval.

Supplemental content

We compared the change in proportion of female authors, female first authors, and female last authors among specialties using a 1-way analysis of covariance. We assessed the relationship between these proportions and journal impact factor using linear regression, adjusting for specialty. We determined the time to incident senior authorship among all authors who published in 2008 as a nonsenior author and used Kaplan-Meier log-rank analysis to compare the time to transition to last author between men and women, censoring at the end of the study period. All analyses were completed in R version 3.5.0 (R Foundation for Statistical Computing) and all *P* values were 2-sided.

Results | In the 274 764 articles analyzed, a gender was identified for 77.5% (1 536 026 of 1 981 454) of authors at the specified threshold. The proportion of women authors increased by 4.2%, women first authors increased by 3.6%, and women last authors increased by 7.8% from 2008 to 2018. There were significant differences in the rate of increase in women as authors ($F_9 = 7.71$; $P < .001$), first authors ($F_9 = 5.73$; $P < .001$), and last authors ($F_9 = 8.76$; $P < .001$) between specialties over time.

The **Figure** shows the change in representation of women as authors, first authors, and last authors over time, separated by specialty. Cross-specialty journals and obstetrics/gynecology showed the greatest increase in proportion of women as first authors (cross-specialty: β = 1.32; $P < .001$; obstetrics and gynecology: β = 1.01; $P < .001$) and last authors (cross-specialty: β = 1.54; $P < .001$; obstetrics and gynecology: β = 1.59; $P < .001$). The **Table** shows the representation of women in authorship positions in 2008 and 2017, as well as

Figure. Temporal Trends for Author Gender Representation by Specialty

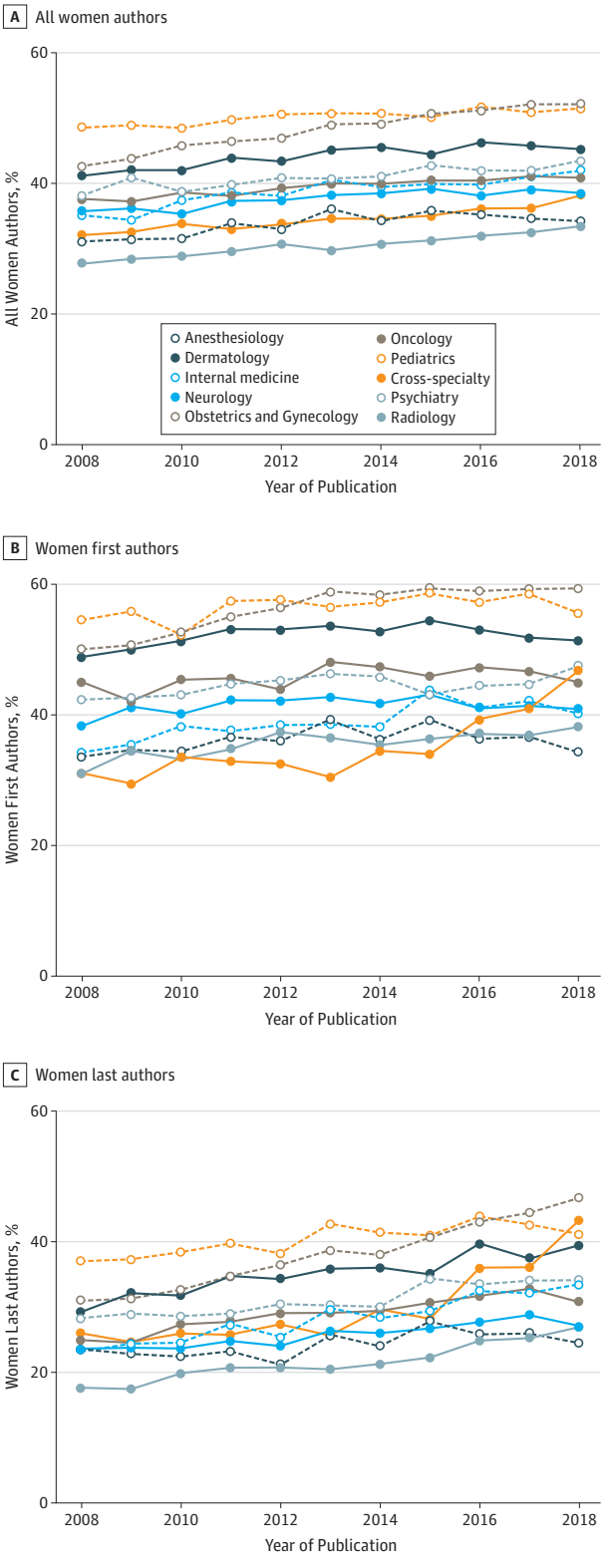

Table. Publication Data and AAMC Faculty Report Data on Author Gender Representation

Specialty	Publication Data, %			Data From AAMC Faculty Report, %
	Women Authors	Women First Authors	Women Last Authors	Women Faculty[a]
Data From 2008				
Pediatrics	48.6	54.5	37.0	49.5
Obstetrics and gynecology	42.6	50.0	31.0	51.9
Dermatology	41.2	48.9	29.2	44.2
Psychiatry	38.1	42.3	28.3	43.7
Cross-specialty	32.1	31.1	26.0	NA
Internal medicine	35.2	34.2	23.3	34.0
Oncology	37.6	45.0	24.9	NA
Neurology	35.8	38.3	23.6	32.6
Anesthesiology	31.2	33.5	23.7	31.9
Radiology	27.8	31.0	17.7	26.7
Total	36.7	41.3	26.1	37.4
Data From 2017[b,c]				
Pediatrics	50.9	58.6	42.6	57.0
Obstetrics and gynecology	52.1	59.2	44.4	62.1
Dermatology	45.8	51.8	37.4	50.2
Psychiatry	42.0	44.7	34.0	51.4
Cross-specialty	36.2	41.0	36.1	NA
Internal medicine	41.1	42.1	32.1	39.4
Oncology	41.1	46.6	32.7	NA
Neurology	39.1	41.4	28.8	39.6
Anesthesiology	34.7	36.7	26.0	36.2
Radiology	32.5	36.8	25.3	29.4
Total	40.8	45.4	33.4	40.8
Data From 2008-2018				
Pediatrics	0.30[d]	0.3	0.57[d]	NA
Obstetrics and gynecology	0.98[d]	1.01[d]	1.59[d]	NA
Dermatology	0.46[d]	0.24	0.89[d]	NA
Psychiatry	0.43[d]	0.33	0.67[d]	NA
Cross-specialty	0.52[d]	1.32	1.54[d]	NA
Internal medicine	0.65[d]	0.70	1.02[d]	NA
Oncology	0.38[d]	0.25	0.74[d]	NA
Neurology	0.34[d]	0.16	0.51[d]	NA
Anesthesiology	0.41[d]	0.21	0.35[e]	NA
Radiology	0.52[d]	0.53[e]	0.87[d]	NA

Abbreviations: AAMC, Association of American Medical Colleges; NA, not applicable.

[a] Association of American Medical Colleges, 2008.[5]

[b] Data are shown for 2017 not 2018 because 2017 is the most recent year for which AAMC data are available.

[c] Association of American Medical Colleges, 2017.[4]

[d] $P < .001$.

[e] $P < .01$.

the total percentage of women faculty in those years according to the Association of American Medical Colleges.[5,6] Although the representation of women as authors in 2017 was similar to the representation of women as faculty overall in that year, some specialties, such as pediatrics, obstetrics and gynecology, dermatology, and psychiatry, had greater representation of women as faculty than as authors. The Table also shows the percentage change in female authorship per year by specialty. Cross-specialty and obstetrics and gynecology journals showed the greatest rate of increase in proportion of women as first authors and last authors ($P < .001$). There was a significant association between a higher impact factor for a journal and the proportion of women as authors ($\beta = 0.11$; $P = .02$), first authors ($\beta = 0.12$; $P = .04$), and last authors ($\beta = 0.17$; $P = .002$).

Articles with a woman as last author were 13.0% more likely to have a female first author than those with a male last author ($\chi^2 = 2534.8$; $P < .001$). Women also exhibited slower rates of transition to last author position (Kaplan-Meier log-rank $P < .001$): the time to 10% transition was 5 years for men, but more than 10 years for women.

Discussion | We find continued increase in the representation of women as authors in academic medicine but demonstrate that disparity still exists, especially in the last author position. Several limitations to our study should be considered. First, our use of Genderize.io represents a tradeoff between accuracy and the comprehensiveness of the data analyzed. Second, these data are representative of publications, not of manuscript submissions. Finally, we have assumed a traditional first/

last author distinction of seniority, which may not always hold. Overall, the variation between specialties suggests the need and the opportunity for continued efforts to support the advancement of women in academic medicine.

Kamber L. Hart, AB
Roy H. Perlis, MD, MSc

Author Affiliations: Center for Quantitative Health, Division of Clinical Research, Massachusetts General Hospital, Boston, Massachusetts.

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Corresponding Author: Roy H. Perlis, MD, MSc, Center for Quantitative Health, Division of Clinical Research, Massachusetts General Hospital, 185 Cambridge St, Simches Research Building, 6th Floor, Boston, MA 02114 (rperlis@partners.org).

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Critical revision of the manuscript for important intellectual content: Perlis.
Statistical analysis: Hart.
Administrative, technical, or material support: Hart.
Supervision: Perlis.

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Assessment of Strategies for Managing Expansion of Diagnosis Coding Using Risk-Adjustment Methods for Medicare Data

Since the passage of the Affordable Care Act (ACA) in 2010, many studies have used national Medicare data to examine associations between national hospital pay-for-performance programs and quality and costs of care.[1-4] In January 2011, as the ACA was being implemented, the Centers for Medicare & Medicaid Services increased the number of available diagnosis billing codes from a maximum of 9 diagnosis codes (the primary diagnosis plus 8 comorbidities; a tenth code was reserved for coding external causes of injury and usually left blank[5]) to 25 diagnosis codes (the primary diagnosis plus 24 comorbidities).

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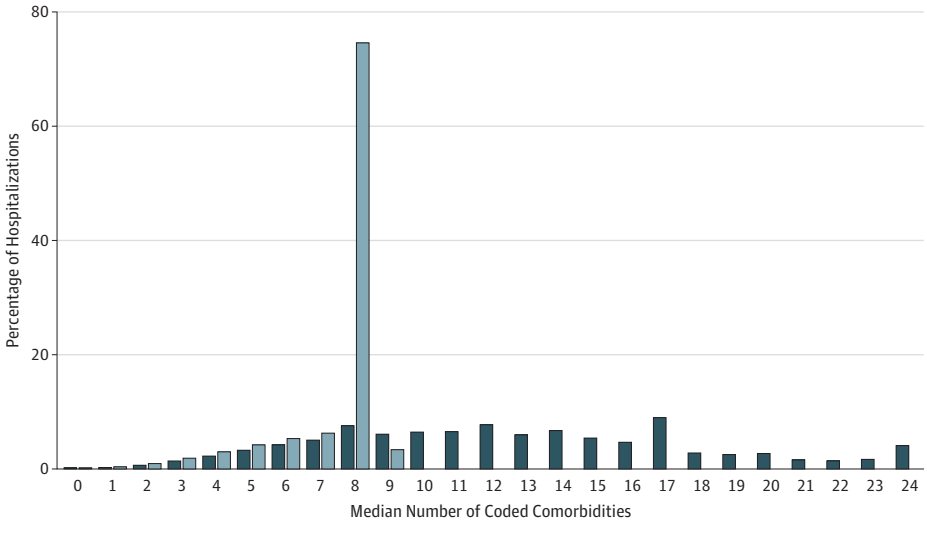
Given that many risk-adjustment models identify comorbidities using these diagnosis codes, this increase may in turn increase the measured severity of illness assigned to each patient. For example, Zuckerman and colleagues[4] found that Medicare's Hospital Readmission Reduction Program was associated with lower readmission rates for targeted conditions. However, more recent studies suggest that the increased number of codes available to hospitals for coding allowed by the change in Centers for Medi-

Figure 1. Number of Coded Comorbidities Compared Between 2008 and 2010 and 2011 and 2012 in Medicare Patients Hospitalized With Acute Myocardial Infarction or Congestive Heart Failure or Pneumonia



Light blue bars represent the number of coded comorbidities for patients admitted to a hospital owing to acute myocardial infarction, heart failure, or pneumonia from 2008 to 2010; dark blue bars for patients admitted from 2011 to 2012.