Association of Women Leaders with Women Program Director and Trainee Representation Across US Academic Internal Medicine

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BACKGROUND: Women are underrepresented within internal medicine (IM). Whether women leaders attract women trainees is not well explored.

OBJECTIVE: To characterize leader and trainee gender across US academic IM and to investigate the association of leader gender with trainee gender.

DESIGN: Cross-sectional study.

PARTICIPANTS: Leaders (chairs, chiefs, program directors (PDs)) in 2018 and trainees (residents, fellows) in 2012–2016 at medical school-affiliated IM and seven IM fellowship programs.

EXPOSURE: Leadership (chair/chief and program director; and, for resident analyses, fellow) gender.

MAIN MEASURES: Our primary outcome was percent women trainees (IM residents and, separately, subspecialty fellows). We used standard statistics to describe leadership and trainee gender. We created separate multivariable linear regressions to evaluate associations of leader gender and percent women fellows with percent women IM residents. We then created separate multivariable multilevel models (site as a random effect) to evaluate associations of leader gender with percent women subspecialty fellows.

KEY RESULTS: Our cohort consisted of 940 programs. Women were 13.4% of IM chairs and <25% of chiefs in each fellowship subspecialty (cardiology: 2.6%; gastroenterology: 6.6%; pulmonary and critical care: 10.7%; nephrology: 14.4%; endocrinology: 20.6%; hematology-oncology: 23.2%; infectious diseases: 24.3%). IM PDs were 39.7% women; fellowship PDs ranged from nearly 25% (cardiology and gastroenterology) to nearly 50% (endocrinology and infectious disease) women. Having more women fellows (but not chairs or PDs) was associated with having more women residents (0.3% (95% CI: 0.2–0.5%) increase per 1% fellow increase, $p<0.001$); this association remained after adjustment (0.3% (0.1%, 0.4%), $p=0.001$). In unadjusted analyses, having a woman PD (increase of 7.7% (4.7%, 10.6%), $p<0.001$) or chief (increase of 8.9% (4.6%, 13.1%), $p<0.001$) was associated with an increase in women fellows; after adjustment, these associations were lost.

CONCLUSIONS: Women held a minority of leadership positions in academic IM. Having women leaders was not independently associated with having more women trainees.

KEY WORDS: women; faculty; graduate medical education; internal medicine; academic medical centers.

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INTRODUCTION

Since 1995, greater than 40% of US medical school graduates have been women[1]. For the first time in history, in 2017, US medical school matriculants were predominantly women (50.7%).[2] Despite this trend, women remain a clear minority of practicing internal medicine (IM) physicians, especially within certain subspecialties. In 2018, women accounted for 41.2% of IM physicians, 17% of cardiologists, and 14.3% of pulmonologists.[3,4]

A robust literature has developed suggesting women may be specifically disadvantaged in academic medicine, a situation exacerbated by the COVID-19 pandemic.[5–12] If and how this may have translated into whether women remain in academic medicine is not yet known. In the USA, after adjustment for relevant confounders, women academic physicians earn approximately $20,000 less annually than their male counterparts[13] and are less likely to attain the rank of Full Professor.[14] Similarly, grant funding—a necessity for academic advancement—may be more challenging for women to

Kantha Medepalli and Stefanie Purdon contributed equally and are co-first authors.

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secure.[15–17] The data that exist regarding gender of academic leaders at the specialist level are sparse, collected inconsistently, and difficult to obtain. Thus, whether these disadvantages translate into a relative lack of women leaders across academic IM departments and subspecialty divisions merits attention.

Studies suggest the presence of women role models may be important to foster engagement of junior women in medical fields. Women medical students are more likely than men to identify role models who are women[18] and believe having women role models in surgery might lead them to consider it as a career.[19] More than two-fifths of women anesthesiology residents state they prefer their mentor to be a woman.[20] Such evidence has led experts to assert that "having female role models in the department is important" to foster the advancement of junior women.[21] However, whether having women in positions of leadership attracts women trainees to IM and IM subspecialty programs has not been specifically examined.

In this study, we characterized the gender breakdown of chairs, chiefs, training program directors (PDs), and trainees across US academic IM and IM fellowships. We subsequently examined the independent association of departmental/divisional leadership gender with PD and housestaff gender across individual training programs after accounting for geography and subspecialty, factors known to be associated with gender disparities in medicine.[22–25] We hypothesized that (1) faculty and housestaff gender would vary by subspecialty and geography (making them appropriate to include as potential confounders in models assessing the associations of faculty and trainee gender); (2) departments/divisions with women chairs/chiefs would be more likely to have women PDs; and (3) programs with women in leadership positions (including faculty leaders—chairs/chiefs and PDs—as well as fellows in the context of residencies) would have a higher percentage of women trainees Table 1.

METHODS

We conducted a cross-sectional study of US academic IM departments and the seven most populous IM subspecialty divisions: cardiology; gastroenterology; pulmonary and critical care medicine; nephrology; endocrinology; hematology-oncology; and infectious diseases. Departmental/divisional institutions were included if they listed an affiliation with a medical school on their website, and if that medical school also listed the institution on their website. Institutions were excluded if they did not have a functioning website. Websites were queried in the fall, 2018.

Individual training program websites were reviewed (fall, 2018) by one member of the investigator team (KM, SP, or RMB) to identify the gender of each department chair, division chief, and PD based on names and/or photographs. Programs with unassignable leader gender were excluded from each relevant analysis. Data obtained from the Association of American Medical Colleges (AAMC) were used to identify the gender of residents training within IM and the seven subspecialty fellowships between 2012 and 2016 (the latest years available at the time of data acquisition and study initiation; 2–6 years preceding the time of PD data collection). Trainee data, contributed by PDs to the AAMC data set, were included for each trainee for every year of their training (2 years for endocrinology, nephrology, and infectious diseases; 3 years for IM and other fellowship programs); because individual trainees were not identifiable, it was not possible to include each trainee only once. Our primary cohort consisted of data collected from all 5 years to provide the most comprehensive picture of each program's gender composition. Subsequent sensitivity analyses were conducted using data from only the final year of available data (2016) to minimize the potential of including individual trainee data more than once, and to utilize the time period closest to the time period of available faculty data.

Our primary exposure was leadership (chair/chief and, separately, PD) gender. Our primary outcome was percent women trainees (IM residents and, separately, subspecialty fellows). We also considered the secondary outcome of PD gender (for analyses considering the exposure of chair/chief gender). We used standard summary statistics to describe the gender breakdown of leadership (chairs/chiefs and PDs) and trainees across IM and the seven IM fellowships. Chi-square and the Kruskal-

Table 1 Association of Women Leaders with Women Trainees

Exposure	Unadjusted Association[a]		Adjusted Association[b]	
	% point difference (95% CI)	*p*-value	% point difference (95% CI)	*p*-value
Model for % Women Residents				
% Women Fellows (per 1% increase)	0.3 (0.2, 0.5)	<0.001	0.3 (0.1, 0.4)	0.001
Woman Program Director	−1.2 (−4.0, 1.5)	0.38	−0.6 (−3.4, 2.2)	0.68
Woman Chair	2.3 (−1.7, 6.3)	0.26	2.1 (−1.9, 6.0)	0.30
Model for % Women Fellows				
Woman Program Director	7.7 (4.7, 10.6)	<0.001	1.6 (−0.4, 3.6)	0.11
Woman Chief	8.9 (4.6, 13.1)	<0.001	1.3 (−1.5, 4.0)	0.37
Woman Chair	1.8 (−2.3, 5.9)	0.38	2.7 (−0.6, 6.0)	0.11

CI confidence interval

[a] *6 models (one for each exposure); no covariates included and, for "% women fellows," site was included as a random intercept*

[b] *6 models (one for each exposure); American Hospital Association (for both models for "% women residents" and "% women fellows") and specialty (for only model for "% women fellows") were included as covariates and site was included as a random intercept*

Wallis testing were used as appropriate to compare faculty and trainee gender breakdowns across specialties and geography. We constructed two multilevel multivariable models with clustering by site to assess factors associated with faculty leadership (chair/chief and, separately, PD) gender. We hypothesized that geography and specialty may be associated with leader (and trainee) gender, thereby potentially confounding their relationship.[22–25] To explore this, both models included specialty (IM and subspecialties) and American Hospital Association (AHA) geographic region as independent variables; the model for PD gender also included chair/chief gender as an independent variable. Post hoc, we constructed two additional models for each outcome (chair/chief and, separately, PD gender) each with a single independent variable: (i) specialty and (ii) AHA region; the purpose of these models was to highlight the individual association of each with leadership gender.

Finally, to assess the association of leadership gender with trainee gender, we constructed a series of multivariable regression models. We created three separate linear regression models to evaluate the association of (1) chair gender, (2) PD gender, and (3) percent of women fellows with percent of women IM residents. In each, AHA region was included as a covariate; clustering by site was not done as each site contributed only one IM residency program. We then created three separate multilevel models to evaluate the association of (1) chair gender, (2) chief gender, and (3) PD gender with percent of women IM subspecialty fellows; subspecialty and AHA region were included as covariates and site was included as a random effect. As a sensitivity analysis, all six trainee-level models were then repeated using only trainee data from 2016.

All statistical analyses were performed with STATA MP 16 (StataCorp, College Station, TX) and Excel (Microsoft, Redmond, WA). IRB approval was obtained from the University of Miami (# 20180799).

RESULTS

Our final cohort consisted of 940 US academic IM and IM fellowship programs of which 146 were IM consisting of 64,641 residents across all study years (Fig. 1). We included >100 programs from each subspecialty fellowship with a range of 2,752 fellows in endocrinology up to 9,941 fellows in cardiology. Cohort programs were geographically diverse (Appendix Figure 1).

Association of Specialty with Faculty Leadership and Trainee Gender

The gender of 5 (3.4%) chairs, 76 (9.6%) chiefs, and 4 (0.04%) PDs could not be assigned. Women accounted for 13.4% of IM department chairs (Fig. 2A). Although division chiefs were predominantly male (>75% across all specialties),

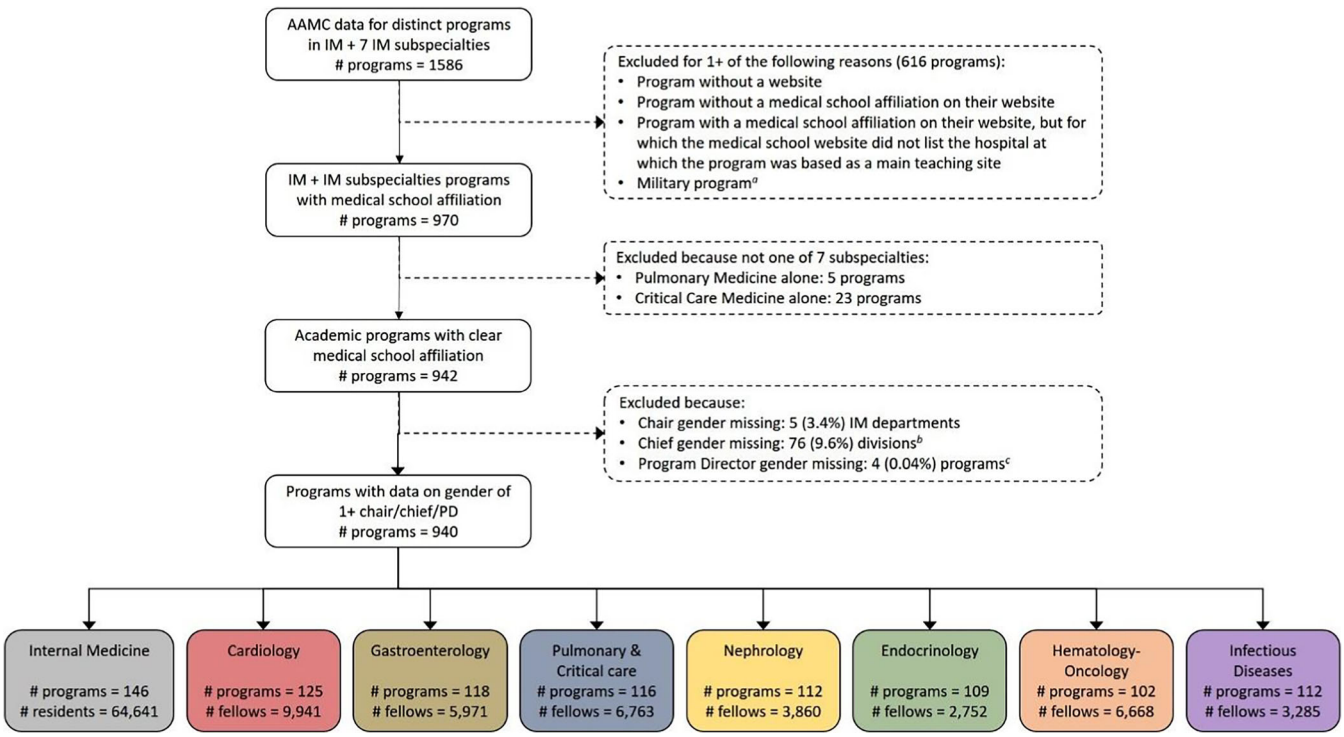
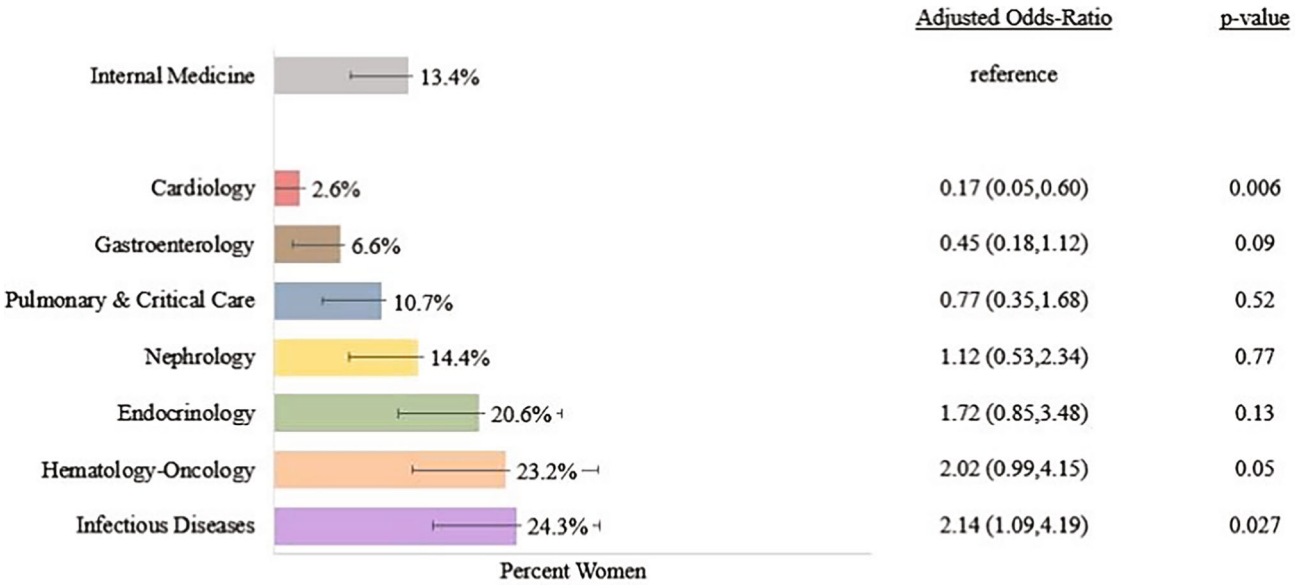


Figure 1 Flow diagram. AAMC, Association of American Medical Colleges; IM, internal medicine. [a]Military programs were excluded as trainee applicants participate in a separate match and also because there were no clear medical school affiliations on military program websites. [b]Chief gender missing for 10 cardiology, 12 gastroenterology, 4 pulmonary and critical care, 8 nephrology, 12 endocrinology, 21 hematology-oncology, and 9 infectious diseases programs. [c]Program director gender missing for 1 internal medicine, 1 endocrinology, and 2 hematology-oncology programs.

A. Chairs/Chiefs[a]



B. Program Directors[b]

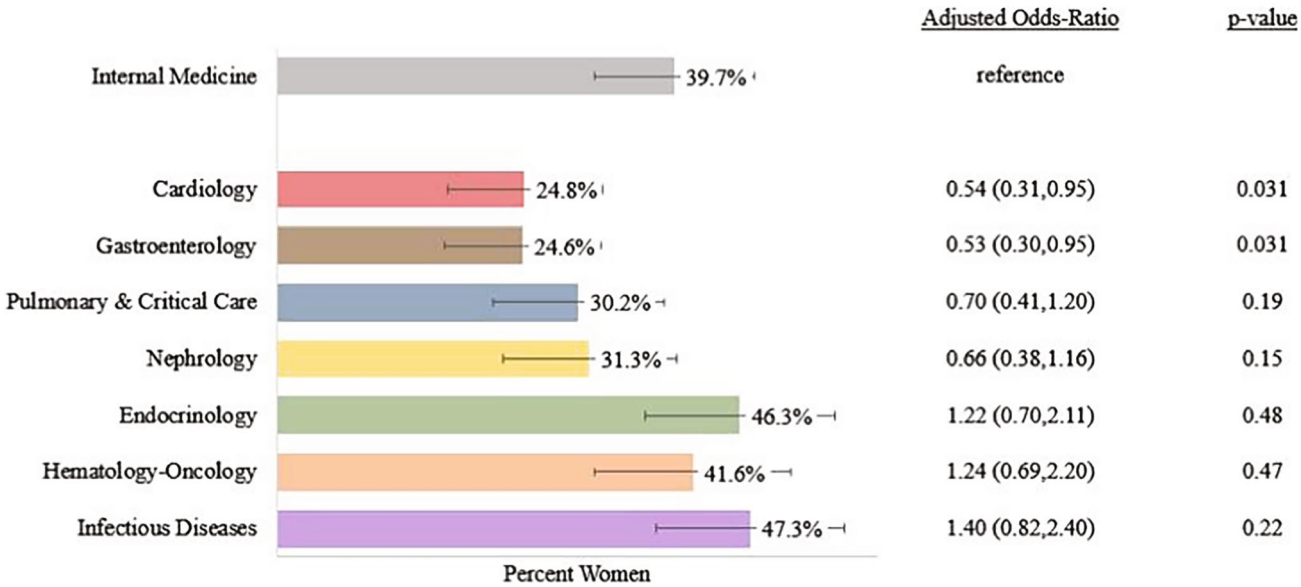


Figure 2 Gender of faculty leaders by specialty. (A) Chairs/chiefs[a]. (B) Program directors[b]. [a]$p<0.001$ for comparison of percent women chairs/chiefs across internal medicine and subspecialties; adjusted model includes specialty and geography as covariates and site as a random intercept. [b]$p<0.001$ for comparison of percent women program directors across internal medicine and subspecialties; adjusted model includes chair/chief gender, specialty, and geography as covariates and site as a random intercept.

infectious diseases (24.3%), hematology-oncology (23.2%), and endocrinology (20.6%) had the most women chiefs; cardiology had the fewest (2.6%). After multivariable adjustment, the odds of having a chair/chief who is a woman were significantly reduced for cardiology (odds ratio (OR), 95% confidence interval (CI): 0.17 (0.05, 0.60), p=0.006) and significantly increased for infectious diseases (2.14 (1.09, 4.19), p=0.027) compared to IM. Similar associations were seen when geography was not adjusted for (Appendix Table 1).

PDs were more commonly women than were chairs/chiefs (Fig. 2B). IM PDs were 39.7% women. In endocrinology (46.3%) and infectious diseases (47.3%), close to half of PDs were women, and in cardiology (24.8%) and gastroenterology (24.6%), nearly one-quarter were women. When compared to IM, the odds of having a woman PD was lower for

both cardiology (OR (95% CI): 0.54 (0.31, 0.95), p=0.031) and gastroenterology (0.53 (0.30, 0.95), p=0.031). Associations were again similar without adjustment for geography.

Finally, IM residents were 43.1% women (Fig. 3A). There was wide variability by subspecialty for fellows—from 22.0% for cardiology to 71.8% for endocrinology.

Association of Geography with Faculty Leadership and Trainee Gender

AHA region 8 (including Arizona, Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming) had the highest representation of women as faculty leaders—24.2% for chairs/chiefs and 51.4% for PDs—while AHA region 6 (including Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota) had the lowest—9.2% for chairs/chiefs and 29.1% for PDs (Fig. 4). After multivariable adjustment, being in AHA region 8 (vs 6) was associated with an increased odds of having a woman chair/chief (OR (95% CI): 3.57 (1.01, 12.57), p=0.047) and PD (3.00 (1.10, 8.18), p=0.031). Being in AHA region 2 (including New Jersey, New York, and Pennsylvania) was additionally associated with an increased odds of having a woman PD when specialty was not adjusted for in the model (Appendix Table 1).

Trainee gender also varied by geography (Fig. 3B), yet less substantially. The highest percentage of women trainees were in AHA regions 9 (including Alaska, California, Hawaii, Nevada, Oregon, and Washington; 46.3%), 1 (including Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, and Vermont; 44.9%), and 2 (including New Jersey, New York, and Pennsylvania; 43.7%). As with women leaders, AHA region 6 (including Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota) had the lowest percentage of women trainees (34.8%). Being in AHA regions 1, 2, and 9 (vs 6) was associated with higher proportions of women trainees after multivariable adjustment (Appendix Table 2).

Association of Chairs/Chiefs and PD Gender

Programs with women chairs/chiefs had PDs that were women 53.3% of the time (Appendix Table 3). After multivariable adjustment, having a woman chair/chief was associated with an increased odds of having a woman PD (OR, 1.92 (1.26, 2.93), p=0.002). Interestingly, when IM departments were chaired by women, only 15.8% of the IM residency PDs were women (whereas 42.3% were women when the chair was a man).

Association of Faculty Leadership with Trainee Gender

In unadjusted analyses, having more women fellows at a given site was associated with having more women residents at that site with an increase in 0.3% (95% CI: 0.2%, 0.5%, p<0.001) in women residents for every 1% increase in women fellows; this association remained after multivariable adjustment (0.3% (0.1%, 0.4%), p=0.001). In unadjusted analyses, having a woman PD (increase of 7.7% (4.7%, 10.6%), p<0.001) or a woman chief (increase of 8.9% (4.6%, 13.1%), p<0.001) was associated with an increase in women fellows; after multivariable adjustment, these associations were lost. In sensitivity analyses restricted to trainee data from 2016, we found similar associations (Appendix Table 4).

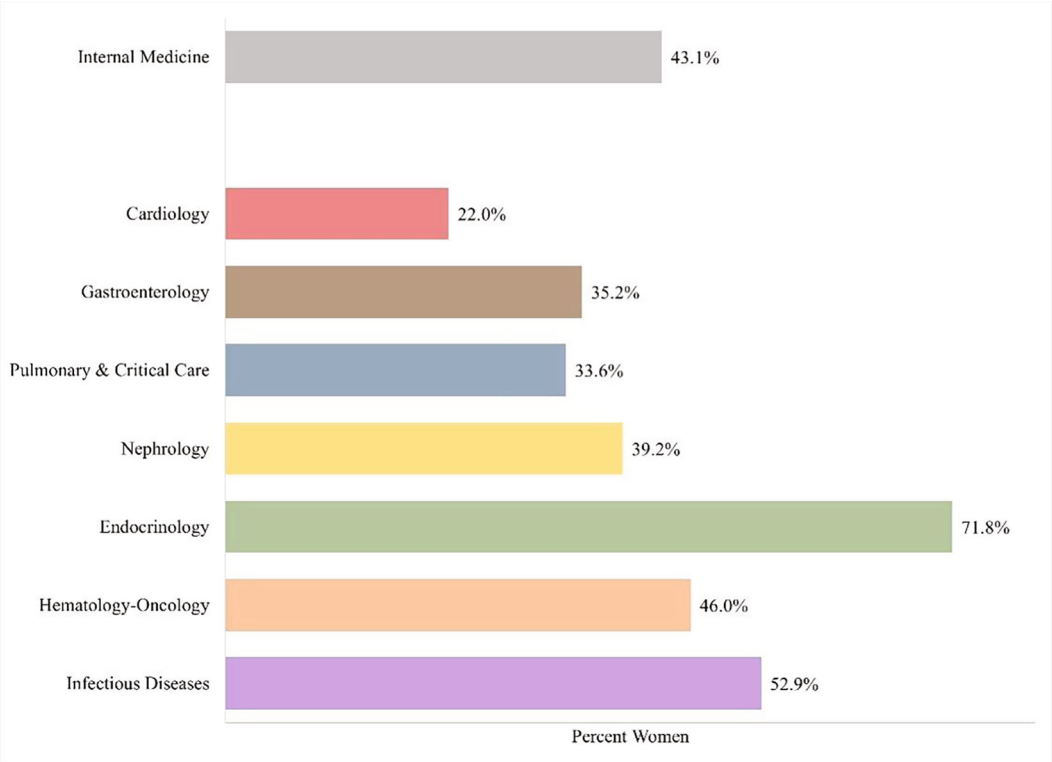
DISCUSSION

We found that women comprised the minority of leaders in academic IM and IM subspecialties. And, while having a woman chair/chief nearly doubled the odds of having a woman PD, having a woman leader (chair/chief or PD) was not associated with having more women trainees. Instead, we found that certain specialties and geographies were associated with greater female representation at all levels.

Our findings are consistent with published literature regarding the representation of women in academic leadership positions. In two recent studies using data gathered from internet searches, 5% of chiefs and 14% of PDs in cardiology, and 18% of chiefs and 24% of PDs in gastroenterology were women.[24,25] Interestingly, while no association was found of having a woman cardiology chief with a woman cardiology PD, similar to our findings, an association was found within gastroenterology (OR (95% CI) for having a woman PD if there was a woman chief: 5.0 (2.1–12.4)). However, neither these studies nor ours can establish causality. Chairs/chiefs can clearly play a meaningful role in selecting PDs; yet, when chairs/chiefs are appointed, existing PDs may not be actively replaced. Moreover, it is possible that more women apply to certain programs due to external factors (e.g., institutional culture) which may confound this association.

It has been asserted that simply having more women in positions of leadership to provide mentorship and/or sponsorship will result in an expansion of women at more junior ranks. Several of our unadjusted analyses did bear this out. Specifically, we found that subspecialty programs with woman chiefs or, separately, PDs did have a higher percentage of women fellows. Sethi et al. found, similarly, that gastroenterology programs with women chairs, chiefs, and/or PDs had more women fellows.[25] In addition, Vranas et al. found the odds of women co-authorship in critical care studies was markedly increased when the senior author was a woman (OR (95% CI) for woman first author: 1.93 (1.71–2.17); middle author: 1.48 (1.29–1.69)).[26] Interestingly, however, we found the association of women leaders with women trainees disappeared once we adjusted for specialty and geography. This disappearance suggests that, rather than women faculty contributing to the choice of specialty selection for women trainees, there are also factors intrinsic to certain fields and/or regions of the country that influence these decisions for both women faculty and trainees alike.

A. By Specialty[a]



B. By Geography[b]

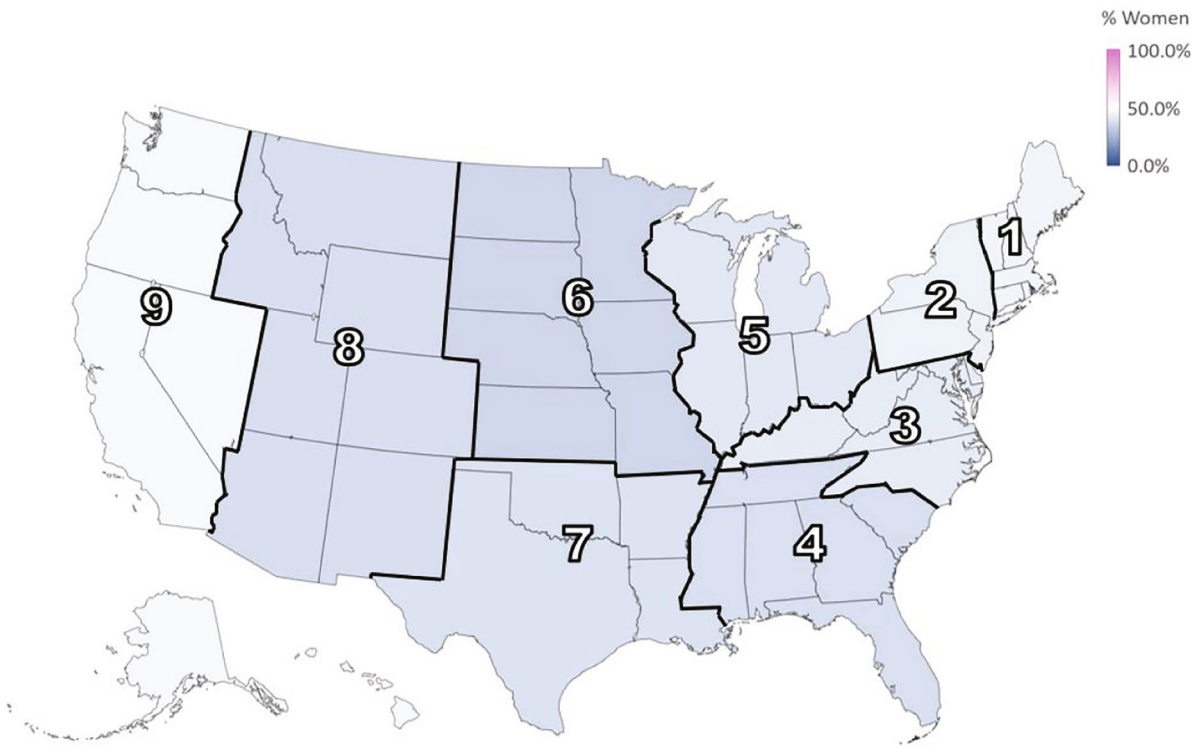
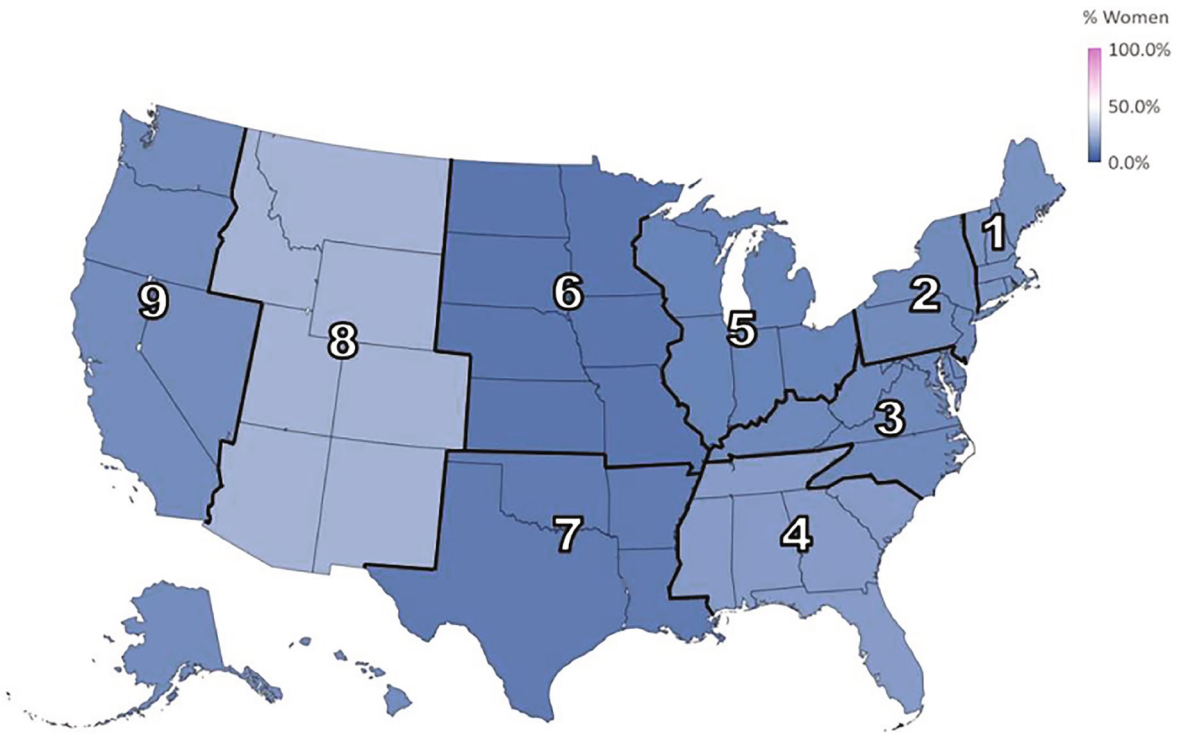


Figure 3 Trainee gender by specialty and geography. (A) By specialty[a]. (B) By geography[b]. [a]Internal medicine trainees are residents and subspecialty trainees are fellows; $p<0.001$ for comparison of percent women trainees across internal medicine and subspecialties. [b]$p<0.001$ for comparison of percent women trainees across geography (by American Hospital Association regions, 1–9; region 9 includes Alaska and Hawaii; region 4 includes Puerto Rico (not shown on map)).

A. Chairs/Chiefs[b]



B. Program Directors[c]

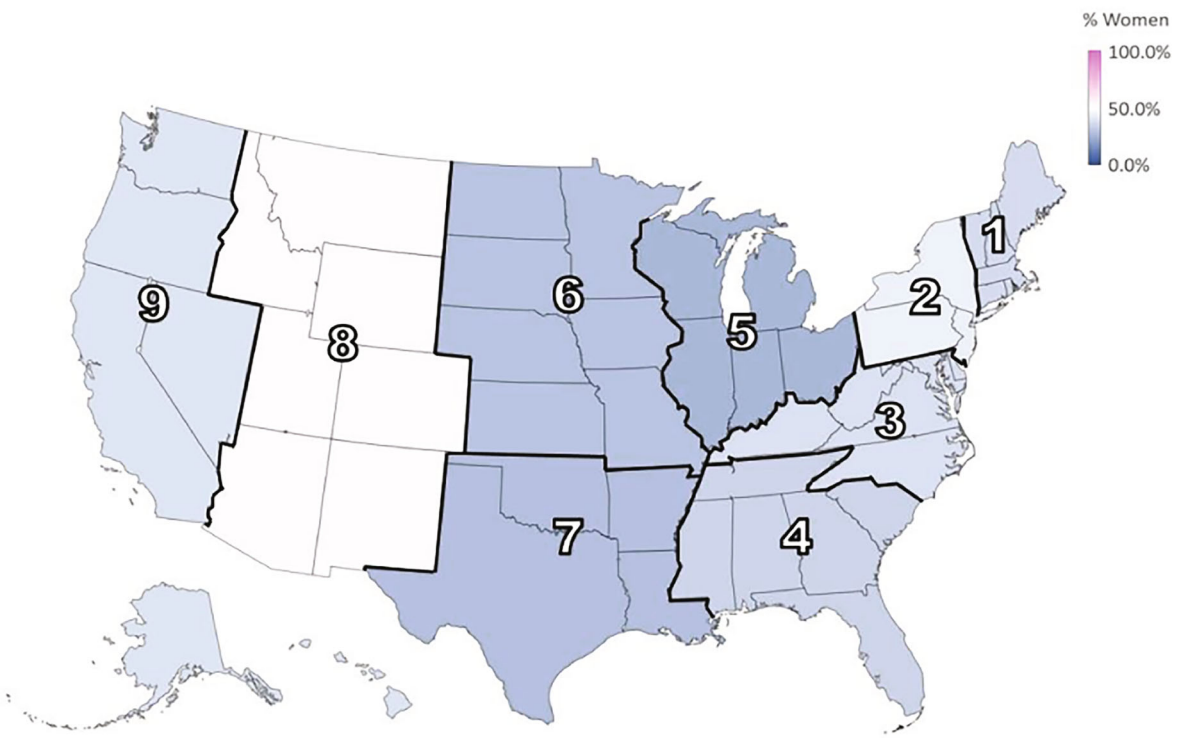


Figure 4 Gender of faculty leaders by geography[a]. (A) Chairs/chiefs[b]. (B) Program directors[c]. [a]The USA divided into American Hospital Association regions (1–9); region 9 includes Alaska and Hawaii; region 4 includes Puerto Rico (not shown on map). [b]p=0.53 for comparison of percent women chairs/chiefs across AHA regions; adjusted model includes specialty and geography as covariates and site as a random intercept. [c]p=0.009 for comparison of percent women program directors across AHA regions; adjusted model includes chair/chief gender, specialty, and geography as covariates and site as a random intercept.

Many factors may enhance the selection of a subspecialty program by women trainees. An institution which has prioritized the active promotion of women into positions of leadership may inadvertently do so more in some subspecialties than in others. Some institutions may be more likely to embark on diversity initiatives: mandating implicit bias training for all faculty and trainees; formal mentorship programs; and, internally funded, formal Women in Medicine leadership positions and seminars/symposiums featuring women faculty. And, while less quantifiable, these institutions may have a culture that makes women feel more accepted and respected. As Rymer et al. demonstrated, a multipronged initiative aimed at creating an inclusive environment can increase women trainee application to and matriculation within a cardiology fellowship program.[27] Included in this initiative were women in positions of leadership and increased visibility of women faculty during fellowship interviews. Importantly, whether and to what degree these specific changes (representing two components of a larger initiative) drove the increase in women fellows are unknown. A similarly multipronged intervention aimed at improving gender equity within the faculty of the Department of Medicine at Johns Hopkins demonstrated that both the importance of identifying targeted interventions and support from leadership are key for change.[28] Notably, in this investigation, the chair was a man, suggesting that female leadership in isolation is unlikely sufficient to improve gender parity.

In light of our study's findings, and the reports of others, we continue to believe that including women in positions of leadership, and having women serve as mentors/sponsors, remains important in medical training. Nevertheless, the factors that are influenced by women in leadership positions are difficult to define precisely and may be multifactorial. For example, we know many women students and trainees seek out women as mentors.[18–20] Women often have different leadership styles than men.[29] Moreover, women and men practice medicine differently.[30,31] Affording trainees, both men and women, exposure to women mentors is essential to ensuring they receive a holistic education. Similarly, there is an urgent need to enhance the diversity of pivotal clinical trial and guidelines authorship groups,[32–35] speaker panels,[36–38] and editorial boards.[39–41] Creating equity in gender representation in academic medicine will provide missing role models for trainees.[42] Yet, our findings suggest that simply hiring and/or promoting women to positions of leadership will not by itself attract women trainees to IM specialties and subspecialties.

The main strengths of this study are our evaluation of both IM and seven IM subspecialty fellowships simultaneously and our adjustment for geography which, together, provide novel insight into potential mediators of the crude associations previously observed between women leaders with women trainees. Several limitations to our study should be noted. Given that our faculty data set was obtained by website review of each institution, misclassification is possible due to website inaccuracies and errors inherent in assigning gender to others based on names/photographs (rather that asking for self-identification). If only leader names were listed (no photographs provided), we searched the internet to identify the gender of the physician. Yet, this technique may have introduced additional bias. Furthermore, we obtained data from the AAMC on trainees from 2012 to 2016 (the latest years available at the time of data acquisition and study initiation); however, our faculty leadership data was collected during the fall of 2018. We anticipate that a small but potentially meaningful number of faculty leaders may have taken new positions (with a subset having different genders) in the intervening years. Trainee recruitment by a PD in 2018 is only assured to impact the trainee class entering in 2019; recruitment of new PDs (or chairs/chiefs) with differing genders occurring between 2011 and 2018 may have resulted in misclassification of our exposure. The only strategy likely to avoid this misclassification bias, however, would be a de novo research survey asking specifically about the composition of programs' faculty and trainees simultaneously. But, the low response rate expected from such a physician-targeted research survey would bias its results and limit its generalizability.[43–46] Moreover, we were unable to track individual trainees across programs; therefore, we could not assess the impact of residents choosing to stay on for fellowship at the same site. Similarly, we were unable to assess or account for trends in faculty leadership gender within institutions; such trends may be associated with trainee recruitment.

Improving the pipeline of women in IM and its subspecialties is an important goal. Improving diversity enables institutions to better mirror the populations they serve and create balance in the workplace. Yet, as our work and the work of others highlight, changing only one element in a system will not likely achieve meaningful improvement. Rather, institutions must embrace a more holistic approach to achieve an inclusive culture that includes intentional training, revamped interview processes, and parity considerations in leadership, mentorship, and representation.[27,28,47] By highlighting the association of geography and specialty with leadership gender, in attracting women trainees, our study contributes to the growing body of literature supporting the need for culture change to achieve the goal of equity for women in academic medicine and in leadership positions. Until we can determine the pivotal aspects of culture to address, all available tools must be applied to foster leadership aspirations among women in academia.

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Author Contribution *Conception and design: all authors; acquisition of data: KM, SP, RMB, HBG; statistical analysis: HBG; interpretation of data: all authors; drafting of manuscript: KM, SP, HBG; critical revision of manuscript: all authors.*

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Declarations:

Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

Disclaimers: *This material is based upon data provided by the Association of the American Medical Colleges ("AAMC"). The views expressed herein are those of the authors and do not necessarily reflect the position or policy of the AAMC.*

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