

Women remain underrepresented in leadership positions in academic gastroenterology throughout the United States

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Abstract

Background Publication history is a key factor in securing academic promotion, but historical underrepresentation of women in gastroenterology may be an ongoing obstacle to achieving gender parity in leadership positions.

Methods We carried out a cross-sectional study of gastroenterology programs in the United States, with data including faculty and trainee names, leadership positions, Hirsch indices, and year of first gastroenterology certification gathered from 1 February 2020 to 1 March 2020. Our outcomes of interest were: 1) sex representation in various leadership positions in academic gastroenterology departments; and 2) mean difference in Hirsch indices between men and women, for which we used univariate and multivariate regression models.

Results Our cohort included 3655 faculty members and trainees across 163 academic gastroenterology programs in the United States. Women comprised 28.7% (1049/3655) of the cohort, including 713/2657 (26.8%) of faculty and 56/289 (19.4%) of all fellowship program directors and divisional/departmental chairs and chiefs. Male faculty had higher mean Hirsch indices compared to women (11.4 vs. 5.5, $P < 0.001$), and when adjusted for year of first gastroenterology certification, men had a larger Hirsch index by 2.8 (95% confidence interval 1.3-4.1, $P < 0.001$). Women were also underrepresented in various subspecialties of gastroenterology, particularly advanced endoscopy.

Conclusions Women in academic gastroenterology remain underrepresented in leadership positions and have lower Hirsch indices than men. Our findings may stem not only from differences in mentorship and career goals, but also from underlying structural factors that disadvantage women.

Keywords Sex disparities, leadership in gastroenterology, underrepresentation

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Introduction

Despite a steady, relatively recent increase in female matriculants to medical school and residency training programs, women have been underrepresented on medical journal boards [1], in publications in high-level specialty journals [2], and in research trials [3]. Throughout their medical careers, female researchers are more likely to receive lower salaries than men, and they are also less likely to report successful sponsorship for both National Institute of Health grants and long-term academic success, as gauged by appointment to senior administrative positions, grant rewards, and publications [4,5]. Even with equal access to funding, disparities in publication persist. This was evidenced in a longitudinal analysis of 1244 medical school faculty members, showing that despite equivalent rates of federal funding for men and women, the latter still had lower Hirsch (h) indices and total publications for unclear reasons [6].

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Gastroenterology (GI) has become one of the more competitive adult medicine subspecialties in recent years and, as in other fields, academic productivity as measured by publication quantity and quality is a key factor in promotion. Our working hypothesis was that women are underrepresented in academic GI leadership positions and in subspecialties of GI, despite having similar markers of publication productivity and career lengths to their male peers. To investigate our hypothesis, we looked at GI programs in the United States (US) to determine sex representation amongst fellowship program directors (PDs), division and department chiefs and chairs, and GI subspecialists, and also to determine trends in publication history and quality as measured by the h-index [7,8].

Materials and methods

This was a cross-sectional study that included faculty and trainee names, h-indices, and year of first GI certification gathered from 1 February 2020 through 1 March 2020. This was to ensure that all h-indices and year of first GI certification were updated through the end of 2019. Similarly, time in practice was calculated from the year of first certification through 2019. Our outcome of interest was mean difference in h-index between men and women, based on geography, faculty position, trainee status, advanced degree, documented subspecialty and year of first certification in GI. Though we focused mainly on GI faculty, we included trainees in our study to determine sex representation throughout the full spectrum of GI academia.

We gathered the names of PDs and their program locations and sizes from the Accreditation Council for Graduate Medical Education website. We identified trainees and other faculty on the program websites and gathered information on who had listed subspecialties, specifically advanced endoscopy, pancreatology, transplant hepatology, motility, and inflammatory bowel disease. We also used program sites and Google searches to confirm sex and to determine whether any faculty member was also listed as a division chief or chair and advanced degree holder. The geographic regions—Northeast, West, South, Midwest, and Puerto Rico—were those defined by the US Census Bureau [1, 9].

The American Board of Internal Medicine website provided the year of first certification in GI and, if applicable, transplant hepatology. This information was used to determine approximate years in practice. In the US, clinical training to become an adult gastroenterologist involves completing 3 years of adult internal medicine residency along with a board certification test, followed by three years of general GI fellowship training, at the end of which the trainee takes a GI board certification exam. After completing a GI fellowship, trainees can pursue further sub-specialization with one year of transplant hepatology—followed by a transplant hepatology board certification exam—or 1-year fellowships in motility, advanced endoscopy and inflammatory bowel disease. Pancreatology can overlap with advanced endoscopy, but is

sometimes its own subspecialty, so we analyzed it separately from advanced endoscopy. We used Scopus to determine each person's h-index and total number of publications for 2019. We chose this server over Google Scholar, Web of Science and others because it limits publications to full-length peer-reviewed manuscripts [10].

Given the lack of uniform reporting on program websites, we did not gather information on professor ranking, trainee level or race. We divided faculty into those listed as Chair/Chief and PD simultaneously, Chair/Chief without PD title, PD without Chair/Chief title, and "other" faculty. We excluded faculty members and PDs for whom we could not confirm their year of first GI certification. We also removed anybody who had multiple or no listed accounts on Scopus, since their h-indices and listed publications could not be definitively verified. Preliminary data were collected from 1 February 2018 through 1 May 2018, then updated from 1 February 2020 through 1 March 2020. Our final cohort included 3655 people, specifically 289 PDs and division chiefs/chairs, 2657 faculty, and 998 trainees.

The New York-Presbyterian Institutional Review Board approved the study (IRB #1157038-1).

Statistical analysis

Univariate regression modeling with *t*-testing was used to estimate the mean difference in h-index between men and women by academic position, listed subspecialty, year of first GI certification and geography. Multivariate analysis controlling for sex and year of first certification allowed us to calculate the mean difference in h-index and total publications between men and women. All analyses were done using R Version 3.4.2 (R Core Team 2017, Vienna, Austria).

Results

Baseline characteristics

We included a total of 3655 faculty members and trainees across 163 academic GI programs in the US. This included 1049 women (28.7%), of whom 713 (68.0%) were faculty and 336 (32.0%) were fellows as of the end of 2019. The proportions of women and men were equivalent by geographic region and advanced degree holders, but men were significantly overrepresented among all faculty (1944/2657; 73.2%), trainees (662/998; 66.3%), and documented subspecialties (Table 1). The cohort's baseline characteristics are summarized in Table 1.

Overall, 56/713 (7.9%) female faculty members were in leadership positions compared to 233/2606 (8.9%) of male faculty members. Of the 289 faculty in leadership positions, women comprised just 19.4% (56/289). Women likewise made up 16.8% (24/143) of the listed chairs/chiefs and 22.7% (37/163) of the PDs. Among documented subspecialists,

Table 1 Baseline characteristics

Variables		Women		Men		P-value (chi-squared analysis)
		Number (n=1049)	Percent (%)	Number (n=2606)	Percent (%)	
Region	Puerto Rico	4	0.381	7	0.3	0.23
	Midwest	221	21.1	634	24.3	
	Northeast	363	34.6	866	33.2	
	South	277	26.4	689	26.4	
	West	184	17.5	410	15.7	
Grouping	Faculty	713	68	1944	74.6	<0.001
	Trainee	336	32	662	25.4	
Academic Position	Chair/Chief only	19	1.81	107	4.1	<0.001
	Chair/Chief AND program director	5	0.5	12	0.5	
	Program director only	32	3.1	114	4.4	
	Other faculty	657	62.6	1711	65.7	
	Fellow	336	32	662	25.4	
Advanced Degree?	MBA	0	0	2	1.3	0.38
	MPH	10	20.8	19	12.1	
	MSPH	1	2.1	2	1.3	
	PhD	37	77.1	134	85.4	
Documented Subspecialty	Advanced Endoscopy	35	3.3	238	9.1	<0.001
	Transplant Hepatology (Certified)	149	14.2	354	13.6	
	Inflammatory bowel disease	82	7.8	163	6.3	
	Motility	38	3.6	73	2.8	
	Pancreatology	6	0.6	34	1.3	

women comprised 149/504 certified transplant hepatologists (29.6%) and 35/273 (12.8%) of advanced endoscopists.

h-Index comparisons

When comparing h-indices for men and women by geographic region, men overall have mean h-indices roughly twice those of women, except for the Puerto Rican institutions. Similar differences arise between men and women listed as division chairs or chiefs, PDs, other faculty, advanced degree holders, and subspecialists, though fellows have roughly similar mean h-indices (0.8 for women vs. 1.2 for men). Our findings are presented in Table 2.

h-Index comparisons by decade

Male faculty overall had higher mean h-index compared to women (11.4 vs. 5.5, $P<0.001$), a statistically significant difference. On multivariate analysis taking account of year of first GI certification, men's mean h-index was 2.8 higher (95% confidence interval [CI] 1.3-4.1) compared to women's; this

difference was also statistically significant ($P<0.001$). This gap was evident and consistent from the 1980s through the 2010s. The gap was especially large in the 1950-1970s group, in which we found no women certified until 1972. Our multivariate analysis also found that men had 14.5 more publications (95%CI 7.8-21.2, $P<0.001$) than women, when adjusted for year of first GI certification. The h-index comparisons are depicted in Table 3.

Comparing career length and publications for faculty

Among all GI faculty, women tended to have been first certified more recently than men (2010 vs. 2000, $P<0.001$), thereby implying a shorter career length overall compared to men. We also found that, overall, women had lower h-indices (5.5 vs. 11.4) and numbers of publications (15.6 vs. 41.9) compared to their male peers, both differences being statistically significant ($P<0.001$). On our subset analysis of the 289 division chairs, chiefs and PDs, women and men were certified at about the same time (2000), suggestive of similar career lengths, though men had a statistically significantly higher mean h-index compared to women (17.8 vs. 10.4, $P=0.005$). Our comparisons are documented in Table 4.

Table 2 Hirsch index comparisons

Variables		Women (n=1049)				Men (n=2606)			
		Median	Mean	Standard deviation	P-value (<i>t</i> -test)	Median	Mean	Standard deviation	P-value (<i>t</i> -test)
Region	Puerto Rico	0	1.8	3.5	0.02	0	0.7	1.3	<0.001
	Midwest	2	6.4	11.2		4	11.7	16.7	
	Northeast	2	4.2	8.1		3	9.7	15.4	
	South	2	5.6	10.6		3	11.8	17.9	
	West	2.5	6.8	11.1		6	14	18.9	
Academic rank	Chair/Chief only	8	11.1	10.2	<0.001	19	23.4	20.3	<0.001
	Chair/Chief AND program director	6	6.4	4.7		8	12.1	15	
	Program director only	6	10.6	13.7		6	13.1	15.5	
	Other faculty	4	7.4	11.5		6	14.5	18.4	
	Fellow	0	0.8	1.6		0	1.2	2.5	
Advanced Degree Holder	MBA	NA	NA	NA	0.81	37	37	52.3	0.02
	MPH	0.5	8.6	18.8		5	7.5	7.9	
	MSPH	4	4	NA		3	3	0	
	PhD	5	11.3	14.2		12	18.2	18.4	
Documented Subspecialty	Advanced endoscopy	5	9.1	12.2	<0.001	9	14.2	14.9	<0.001
	Transplant hepatology (Certified)	5	10.2	14.1		13	20.7	21.2	
	Inflammatory bowel disease	4.5	7.6	9.6		10	18.3	21.2	
	Motility	3.5	5.7	6.7		20	22.3	21.2	
	Pancreatology	7.5	11.8	12.8		22	25.4	22.3	

Table 3 Hirsch index comparisons by decade

Year of first gastroenterology certification	Women (n=713)			Men (n=1944)			P-value (<i>t</i> -test)
	Median	Mean	Standard deviation	Median	Mean	Standard deviation	
1950-1970s	12.5	10.7	5.9	14	22.4	22.8	<0.001
1980s	10	18.6	25	11	20.9	23.2	
1990s	8	14.7	16.2	17	20.8	20.6	
2000s	5	9.2	9.9	9	11.9	11.4	
2010s	3	3.5	3.8	3	4.8	5.9	
Overall	2	5.5	10.1	4	11.4	17	<0.001

Discussion

We were able to evaluate a large cross-section of GI programs in the US and focus on sex representation in leadership positions and within particular subspecialties, using data through 2019. Though we found a trend toward more equal representation between men and women among more recent graduates and among trainees, women overall remain underrepresented among PDs, division and department chairs or chiefs, and other faculty as a whole.

Notably, the proportion of female faculty in leadership positions (56/713; 7.9%) was about equal to that of male

faculty (233/2606; 8.9%), which could imply that women are being promoted at similar rates to their male counterparts. Indeed, we had found that male and female division chairs, chiefs and PDs had similar career lengths—about 19 years—as reflected by year of first GI certification (2000). If women join GI ranks in increasing numbers and if promotion rates remain equal, then women should theoretically make up a larger share of leadership positions in the near future. The sex imbalance nonetheless persists at the faculty level, where women comprised about one-fourth (713/2657; 26.8%), and in leadership positions, where women held one-fifth of spots (56/289; 19.4%).

Table 4 Comparing career length and publications for gastroenterology (GI) faculty

Variables		Women			Men			P-value (<i>t</i> -test)
		Median	Mean	Standard deviation	Median	Mean	Standard deviation	
All GI faculty (n=2657)	Year of first GI certification	2010	2010	9.0	2000	2000	12.6	<0.001
	Hirsch index	2	5.5	10.1	4	11.4	17.0	<0.001
	Total number of publications	3	15.6	37.9	7	41.9	80.4	<0.001
Chair/Chief and/or program directors (n=289)	Year of first GI certification	2000	2000	7.4	2000	2000	10.4	1
	Hirsch index	6.5	10.4	12.0	10	17.8	18.5	0.005
	Total number of publications	15	30.8	44.4	28	69	100.0	0.006

This lack of female visibility can have an impact on attracting female applicants to training programs, thereby perpetuating further underrepresentation. A recent study noted that at least 43% (74/173) of US GI fellowship programs had no women as chairs, division chiefs, PDs or associate PDs, and that the presence of either a female PD or associate PD was associated with a greater proportion of female fellows (4.0 women vs. 3.2 men, $P=0.08$; and 4.3 vs. 3.4 men, $P=0.04$, respectively) [11]. Another survey of 125 GI division chiefs, PDs and leaders from the American Society of Gastrointestinal Endoscopy highlighted the lack of female mentorship for women, with women more likely than men to report wanting to have a same-sex mentor (60% vs. 25%, $P<0.001$), though only 4% of all respondents had a sole female mentor [12]. The same authors found that female GI leaders were more likely than men to have had a promotion within 6 years of finishing training (81% vs. 62%, $P=0.05$) and they did not remain childless or otherwise delay having children compared to male peers, yet women still felt they were treated differently by patients and underpaid (73% vs. 13%, $P<0.001$).

Our view is that the lack of female mentor and leader figures has wide-ranging consequences, in particular that female trainees may perceive that colleagues and faculty have lower expectations about endoscopic skill, competence and work ethic [13], and these may then lead some women to leave academia altogether to work elsewhere [14]. Indeed, a recent survey of 210 gastroenterologists in private practice and in academic programs found that female respondents were less likely than men to have a current leadership role (36% vs. 52%, $P=0.03$) [15]. Of note, when the authors looked specifically at respondents who had completed their training within 5 years of the survey, more women than men were in leadership positions (25% vs. 6%), though there was no statistically significant difference ($P=0.11$). The difference between their findings and ours may be due to their smaller sample size and possibly to leadership openings in non-academic settings. Jagsi *et al* noted that, among elite early-career physicians, women remained underpaid compared to men after adjustment for specialty, academic rank, work hours and research time [16]. Even with leadership positions available [17], a considerable number of women may still feel that they must work harder than their male peers, whether they reach the same benchmarks for success or fall short [18]. Long *et al* observed that, while the percentage of female authors of original research in major GI

journals increased over 20 years, the percentage of women listed as senior authors remained low [19].

This finding may be connected with our own finding on multivariate analysis that men have a higher h-index and total number of publications, even after adjustment for year of first GI certification and for seniority. Our findings differ from those of our colleagues Diamond *et al*, whose cross-sectional study in 2014 of 2440 faculty in 114 GI programs found that h-indices and publications were equivalent for male and female faculty, even in senior positions. We ascribe these discrepancies to our moderately larger sample numbers of people ($n=2657$) and programs ($n=163$), in addition to our use of the year of first GI certification to establish the start of an academic GI career, whereas their study used year of first publication to determine career duration. We also simplified our definition of leadership positions to include only division or departmental chairs/chiefs and fellowship PDs. Professor ranking was outside the scope of our study, because we did not have a reliable way to verify this. In our study, women in leadership positions had lower mean h-indices and total publications, despite similar career length as gauged by mean year of first GI certification. Part of this may simply reflect different career goals that are not captured by bibliographic measures, for instance involvement in committees, administration, and educational activities that can factor into leadership consideration [20,21]. Elsewhere in academic medicine, researchers have noted similar patterns of sex disparities in leadership positions and faculty retention [14,22], in training programs [23], and in salaries [24], so our findings are consistent with those noted broadly in academic medicine. Apart from career goals, women are more likely than men to face workplace hostility [25], gender bias [26], lack of mentorship or research funding [27,28], unfair pay structures [5,29], greater expectations for parenting and domestic responsibilities [30], and inadequate parental leave policies [31], all of which can negatively impact research productivity.

Mentoring from early career stages is especially important, since h-indices favor researchers with longer careers, whose studies have had a chance to circulate and accrue citations. Mentorship is also vital to facilitate junior faculty members' successful pursuit of research grants, which can then lead to publications, promotions and job satisfaction [28,32,33]. A lack of mentorship could dissuade women from pursuing certain subspecialties within GI, for instance advanced endoscopy,

where 4.9% (35/713) of female faculty are specialized compared to 12.2% (238/1944) of male faculty, in contrast to transplant hepatology (149/713, 20.9% of female faculty vs. 354/1944, 18.2% of male faculty) or inflammatory bowel disease (82/713, 11.5% of female faculty vs. 163/1944, 8.4% of male faculty). Our view is that more women would be encouraged to become advanced endoscopists if they had female mentors; they may gravitate toward other subspecialties because of the greater visibility and encouragement of female peers in those fields. Woodward *et al* observed that PDs were more likely to be female if their division chief was also female [34]. Thus, until a critical mass of female mentors is reached, female trainees may opt for alternative career options, or may not be selected at all. Other researchers have identified structural and cultural features elsewhere in academia that can dissuade women and people of color from entering scientific careers [32,35], including but not limited to sexual harassment and historical “gender responsibilities” [36,37].

We call upon our peers, not just in GI, but also in other areas of medical education and clinical training, to be conscious of the underrepresentation of women, not only amongst their trainees and students, but also among their leadership ranks and advanced endoscopy. Without equality in mentorship and representation in leadership, groups that are historically disadvantaged will continue to struggle for recognition, research funding, networking and promotions, and newer generations of trainees will fall into the same cycle [38]. Though improvements in sex representation are evident among younger GI physicians in our study, the gaps in representation and bibliometric measures persist and underscore how much work is left to be done. Issues including the equal salaries and consistent parental leave policies are likewise areas that can help dismantle perceptions of unfair treatment and gender hostility.

Our own study has its shortcomings: for instance, it drew upon data sources such as program websites to identify chairs, chiefs and subspecialties, but websites are not necessarily updated or standardized for all programs. We sought to mitigate this by collecting data over a short period in early 2018 then updating everything in early 2019, but the program websites were not necessarily changed in the interim. Moreover, the h-index and number of publications measure one aspect of academic achievement and cannot account for those whose career goals involve educational and scholarly activities outside of writing research papers. We used these measures since they are objective and commonly used when considering promotions in academia, but they nonetheless remain an imperfect reflection of an individual’s scholarly contributions. Our study did not look at non-academic GI positions, such as in community practices, so this is a potential area for research into sex representation in leadership positions and possible inequalities in work-related experiences.

In conclusion, sex disparities persist in academic GI with regard to leadership positions, GI subspecialties, and scholarly productivity as measured by h-indices. The lower h-indices, among other various structural obstacles, can in turn prevent more women from progressing to leadership positions, thereby exacerbating underrepresentation.

Summary Box

What is already known:

- Publication history is a key factor in securing academic promotions
- Women have been historically underrepresented in gastroenterology, but their numbers have been rising in recent years
- Recent studies suggest that women have achieved equal publication productivity with men in academic gastroenterology

What the new findings are:

- Women remain largely underrepresented in departmental, divisional, and fellowship program leadership positions, as well as at all faculty and trainee levels
- Women have narrowed the gap in publication metrics with men, though disparities in leadership representation and publications persist and may be due to the historical underrepresentation and ongoing lack of mentorship and support compared to men
- Certain subspecialties within gastroenterology, in particular advanced endoscopy, have significant underrepresentation of women among faculty, which may discourage women from pursuing careers in these fields

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