Gender Differences in Publication Productivity, Academic Rank, and Career Duration Among U.S. Academic Gastroenterology Faculty

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Abstract

Purpose
Female representation in academic medicine is increasing without proportional increases in female representation at senior ranks. The purpose of this study is to describe the gender representation in academic gastroenterology (GI) and compare publication productivity, academic rank, and career duration between male and female gastroenterologists.

Method
In 2014, the authors collected data including number of publications, career duration, h-index, and m-index for faculty members at 114 U.S. academic GI programs.

Results
Of 2,440 academic faculty, 1,859 (76%) were men and 581 (24%) were women. Half (50%) of men held senior faculty position compared with 29% of women (P < .001). Compared with female faculty, male faculty had significantly (P < .001) longer careers (20 vs. 11 years), more publications (median 24 [0–949] vs. 9 [0–438]), and higher h-indices (8 vs. 4). Higher h-index correlated with higher academic rank (P < .001). The authors detected no difference in the h-index between men and women at the same rank for professor, associate professor, and instructor, nor any difference in the m-index between men and women (0.5 vs. 0.46, respectively, P = .214).

Conclusions
A gender gap exists in the number and proportion of women in academic GI; however, after correcting for career duration, productivity measures that consider quantity and impact are similar for male and female faculty. Women holding senior faculty positions are equally productive as their male counterparts. Early and continued career mentorship will likely lead to continued increases in the rise of women in academic rank.

Over the last four decades, the proportion of women practicing medicine has dramatically increased. Prior to 1972, women earned approximately 9% of medical degrees in the United States; by 2013, that percentage increased to nearly 50%.1 According to data from the Journal of the American Medical Association medical education theme issue, this trend of increasing female representation in medicine is evident across all levels of medical training and in almost every subspecialty.2 Even internal medicine subspecialties that have been traditionally male dominated, such as cardiology and gastroenterology (GI), have seen an increase in female representation, particularly since 2000. To illustrate, the percentage of women among GI fellows has risen each year and has remained above 30% since 2009.2 Female representation in academic medicine has also been increasing. According to Association of American Medical Colleges (AAMC) data, women constituted nearly two-fifths (39%) of full-time faculty in fully accredited U.S. medical schools in 2013.3 However, despite an overall narrowing of the gender gap in academic medicine, women continue to hold far fewer senior leadership positions than men. According to the AAMC Statistics and Benchmarking Report from 2013–2014, only 21% of full professors, 14% of department chairs, and 12% of medical school deans are women.1

The reasons for the persistent underrepresentation of female faculty at senior levels of academic medicine in general, and academic GI specifically, are multifactorial and complex. The path to promotion is multifaceted; however, scholarly productivity remains a critical component of academic advancement. Given the observed gender gap in academic GI, we hypothesized that, compared with their female colleagues, male academic gastroenterologists would achieve higher academic rank and enjoy higher publication productivity (both in sheer numbers and as measured by metrics that consider quality and impact). In this study, we aimed to describe the current gender representation in academic GI and to assess whether differences exist within career duration or within some of the widely accepted surrogate measures of scholarly inquiry, including the number of publications and metrics that measure publication quality and impact, between men and women in this field.

Method
Ethical approval and inclusion/exclusion criteria
This study constitutes an analysis of publically available data, and as such, the institutional review board at Oregon Health & Science University deemed it exempt. We acquired a comprehensive list of 161 GI fellowship programs accredited
by the Accreditation Council of Graduate Medical Education (ACGME) in the United States. With the help of local gastroenterologists, we classified programs as either nonacademic or academic (i.e., having a primary affiliation with a medical school or university hospital). All physician (MD, MD/PhD, and DO) faculty members at academic programs constituted the primary cohort; we excluded nonphysician (PhD, PA, NP) faculty members.

Bibliometric measures of research productivity: h-index and m-index
We considered multiple measures of research productivity. We collected the total number of publications for each faculty member in the cohort, as well as metrics that measure quality and impact.

We used the Hirsch-index (h-index), a metric first described in 2005 by physicist Jorge E. Hirsch, as one of our measures of scholarly activity. The h-index is defined as the number of papers (n) published by an individual that have at least n citations. The h-index provides insight into the impact of an author’s work by taking into account the frequency with which each of his or her articles is cited. The h-index for each author is calculated on the basis of the set of most cited papers and the number of citations that each paper has received in other publications. Thus, the h-index quantifies the impact an author is having on the body of literature as a whole. For example, an author who has published 100 articles, each of which has been cited only once, will have an h-index of 1, whereas an author who has published 5 publications, each of which has been cited at least 5 times, will have an h-index of 5. Authors’ h-indices are now widely available through online search engines such as Google Scholar, SCOPUS (Elsevier BV, Amsterdam, The Netherlands), and Web of Science (Thomson Reuters). Other investigators have previously used this measure to compare scholarly activity among faculty of various medical specialties in the United States. One prior study of faculty of various medical specialties to compare scholarly activity among physicians included over 57 million records, and it catalogues over 20,000 peer-reviewed journals, including articles-in-press, and over 100,000 books. Furthermore, the author discrimination tool featured in this database helped to ensure that the publications were being ascribed to the correct individual. The h-index derived from the SCOPUS database is based on all publications after 1996. We used SCOPUS as our source of each author’s h-index and his or her total number of publications.

Because the h-index is inherently dependent on the length of time an author has been publishing, scholars have created a correlating metric, the m-index, to correct for an author’s career length and allow for comparison among authors of varying career duration. The m-index is the h-index divided by the number of years (x) since the author’s first publication: m-index = h-index / x. For example, an author with an h-index of 5, whose career duration is 5 years, will have an m-index of 1, whereas an author with the same h-index of 5, but a longer career duration of 20 years, will have an m-index of 0.25. Others have previously described the m-index as a predictor of future publication success and have used it to compare productivity of individuals with different career duration. For our study, we used the year of first publication as a surrogate for the beginning of an author’s academic career, and we calculated career duration by subtracting the year of first publication from the year of data collection (2014).

Data collection
Two of us (S.J.D., B.K.E.) collected all data between April 19, 2014, and May 3, 2014. We decided on this time interval a priori to limit the possibility of ongoing publication during a lengthy data collection time frame. We recorded faculty name, gender, academic rank (professor, associate professor, assistant professor, or instructor), and degree (MD, MD/PhD, or DO) for faculty at all academic GI fellowship programs by accessing publicly available GI division and departmental Web sites. Using a standardized search method developed in previous studies of other specialties, we used the SCOPUS database to obtain each author’s total number of publications, year of first publication, and derived h-index (calculated by SCOPUS on the basis of the set of publications from 1996 to March 2014). When a search for a name retrieved multiple listings, we cross-referenced previous and current practice locations, as well as field of study, to ensure that we were recording the correct faculty member’s h-index. If a division’s Web site did not include a list of faculty, we contacted the program coordinator through e-mail to obtain a list of faculty members and the academic rank of each. If a program coordinator or some other representative did not respond to requests for information within the study time frame, we excluded the program from analysis. We used departmental Web site photographs to determine gender. If no photo was available, we obtained gender from the publicly available Healthgrades Web site. If we could not find a faculty member in SCOPUS, we cross-referenced PubMed and the American Board of Internal Medicine (ABIM) Web site. If ABIM identified a faculty member as board certified, but we could not find him or her on SCOPUS or PubMed, we assumed that the faculty member had zero publications.

Statistical analysis
We used univariate analyses, chi-square, and Mann–Whitney U to analyze data across nonparametric groups. We stratified data by gender, academic rank, and career duration. We performed all calculations using SPSS statistical software (version 22; IBM, Armonk, New York).

Results
Of 161 ACGME-accredited GI training programs, we identified 122 (76%) as academic. Of these academic programs, we excluded 8 (7%) because of missing data. There were 2,498 faculty members in the 114 academic GI programs included, and of these we excluded 58 (2%) because of incomplete bibliographic information; thus, 2,440 faculty members were in the final cohort for analysis (Figure 1). Of these, 581 (24%) were women and 1,859 (76%) were men.
Academic rank

Among the 581 female academic gastroenterologists we studied, 11% (n = 63) held the rank of professor compared with 30% (n = 557) of the 1,859 male gastroenterologists in our cohort (P = .0009) (Table 1). Of the men in our cohort, half (50%, n = 921) were senior faculty (professor or associate professor) compared with only 29% (n = 169) of the women (< .001). The most common academic rank held by women in our cohort was assistant professor: 47% of women (n = 272) in the sample held this position.

Career duration, number of publications, h-index, and m-index

The median overall career duration of academic gastroenterologists in our cohort was 18 years (range 0–76). Men had significantly longer median career lengths compared with women (20 vs. 11 years, P < .001).

The median number of publications for the cohort was 19 (0–949). Men produced a median of 24 (0–949) publications, and women produced a median of 9 (0–438) publications (P < .001). Men in every academic rank other than associate professor had a higher median number of publications than women. Among professors, men had a median of 103 publications (0–949) compared with a median of 72 (2–438) for women (P = .008). Among associate professors, the median number of publications for men was 30 (0–327) compared with a median of 32 (0–247) for women (P = .91). Male assistant professors had a median of 9 publications (0–169) compared with a median of 6 (0–84) for female assistant professors (P < .001).

The overall median h-index for the cohort was 6 (0–99). Men achieved a median h-index of 8 (0–99) compared with a median h-index of 4 (0–76) for women (P < .001) (Table 1). When stratified by academic rank, a higher h-index was significantly correlated with higher academic rank for both men and women (Figure 2). We detected no difference in h-index between men and women holding the same academic rank—except among assistant professors. Male assistant professors achieved an h-index of 4, while female assistant professors achieved an h-index of 3 (P = .013).

The overall median m-index for the cohort was 0.5 (0–6). We detected no statistical difference in the median m-index between all men (0.5; range 0–6) and all women (0.46; range 0–3) in the cohort (P = .214), nor in the median m-index of men and women across academic rank.

Subgroup analyses

The last decade. Given the more recent trend of higher representation of women in medicine and GI, we performed a post hoc subgroup analysis of faculty members whose career duration was less than 10 years to assess for a gender gap in research productivity among faculty who were relatively new to academic GI. Of the 1,859 male faculty members, 416 (22%) were men who had begun their careers within the last 9 years, and of the 581 female faculty members, 257 (44%) were women who had begun their careers within the last 9 years. Among these relatively newer male and female faculty members, we detected no difference in either the median number of publications (4 for both genders, P = .21) or the median h-index (2 for both, P = .38).

Highly productive men and women.

We also performed a post hoc subgroup analysis of the most productive faculty (top 10%) of each gender (see Figure 3). In this cohort, 186 men and 58 women constitute the top 10% within each gender. All of these faculty members were professors. The mean age of the most productive men, 60 years (standard deviation [SD] = 8.6 years), was significantly higher than that of women, 57 (SD = 5.3) years (P = .03). The median duration of careers for men, 29 years (15–54), was significantly longer than that of women, 25 (6–46) years (P = .006). Men had a median of 208 publications (72–949) compared with a median of 74 (2–438) publications for women (P < .001). These productive male faculty members had a median h-index of 43 (34–99) compared with a median h-index of 27 for women (21–76; P < .001). The median m-index for men was 1.60 vs. 1.23 for women (P < .001).

Discussion

This study demonstrates that a gender gap exists in female representation among academic gastroenterologists; women represent less than one-fourth of the academic gastroenterologists in our cohort. Additionally, a gender gap exists in research productivity as measured by the h-index; however, our data indicate that this difference is largely driven by the longer careers of male gastroenterologists.
We detected no significant difference in the m-index, and subgroup analyses of the h-index of faculty who have been in practice for fewer than 10 years suggest that the gender gap in research productivity may be beginning to close.

Increasingly, academic settings, including medical schools, are developing various “tracks” by which their faculty members can advance to higher academic ranks. These pathways include traditional, research, clinical, and clinician–educator tracks. Although these individualized tracks are becoming increasingly common, the various pathways are not standardized across different university settings, and faculty members are not consistently designated by a specific track on a division’s Web site. Further, gender differences might exist among these pathways. For example, recent data show that women are more likely to choose a clinician–educator track than a traditional tenure track. Given the highly inconsistent specific labeling, these differences were not amenable to further analysis in our study.

The barriers to academic advancement for female physicians in academic medicine are multiple. Professional women often face the unique challenge of managing a career, running a household, and raising children. The responsibilities that women traditionally carry outside of the workplace may lead to work–life conflict that, in general, has affected men less than women. This conflict may contribute to the attrition of women from the workforce and their lesser representation at higher ranks on the academic ladder. Additionally, evidence suggests that funding is unevenly distributed between men and women. To illustrate, one Swedish study of MD/PhD candidates showed that women, compared with men, asked for less research money and were less likely to receive grant funding. In another study, Jena and colleagues demonstrated that men and women applying for grant support for basic science research were awarded dramatically variable startup packages; the median startup packages for men were approximately 67% higher than those for women ($980,000 compared with $585,000). Finally, considerable literature from the social sciences suggests that women in medicine, like all women, face challenges related to unconscious biases that may limit their opportunities and affect the evaluations of their work.

Mentorship plays a vital role in the advancement of young faculty in academic medicine. Mentorship not only adds to career satisfaction but also doubles any physician’s chance of being promoted. Despite the importance of mentorship for success and satisfaction in academics, far too few men and women report sufficient career guidance. According to one review, fewer than half of all medical students and less than 20% of faculty had a mentor. If fewer women are in leadership positions, a greater proportion of early-career women, compared with early-career men, may lack gender-matched mentors, and this paucity may also contribute to fewer women achieving higher academic ranks.

There are several limitations to our study. First, we obtained our list of faculty members from departmental Web sites and program coordinators, and it may be inaccurate or out of date. Second,
accounting for potential name changes was challenging. If a woman published under another name, some of her publications may not be included in the calculation of her h-index, and her h-index may have been falsely low. We attempted to account for this possibility by reviewing, when available, the curricula vitae of female faculty members. However, a previous study showed that name changes affect only 12% of women during their publishing career, and of those, the name change influences the h-index of only 8%.7

Third, we may have inaccurately identified the gender of the faculty members in our cohort. Another limitation is that the year of first publication, used as a surrogate for the beginning of the author's academic career, may overestimate or underestimate the author's true career duration. Also, while the SCOPUS database catalogues the number of publications of each author throughout the author's entire career duration, it does not identify the position of authorship (i.e., first or last author). SCOPUS uses only publications after 1996 to derive the h-index for each author, which affects the h-index of men and women with publications prior to 1996. Men and women whose careers began well before 1996 are likely to have falsely low h-indices because of this limitation.

Because significantly more men than women were practicing GI before 1996, the overall h-index of men may be falsely low.

This study also has multiple strengths. To our knowledge, it is the first to use a systematic, standardized approach among a large, comprehensive group of subjects to quantify the gender differences among academic gastroenterologists. Defining and quantifying the gender differences in this traditionally male-dominated, procedural-based subspecialty may be a step toward closing the gender gap. Given the increasing interest in gender equality and greater focus on improving mentorship in academia, our report provides timely data. The data collection of the bibliometric indices was performed using a homogenous search method by two investigators (S.J.D. and B.K.E.) during a predetermined two-week period. This "snapshot-in-time" approach provides information that can serve as a baseline for repeat analyses, which will allow us to measure trends over time. Further, we used a comprehensive database—SCOPUS—that indexes not only published journal articles and chapters but also manuscripts that have been accepted for publication.10

In summary, the trend in increasing female presence in medicine over the last several decades is encouraging, but a gender gap still exists in academic GI. Given our results, we believe this gap may be driven in part by differences in career duration. The difference in productivity also appears to be associated with differences in academic rank. Data from faculty who have been in practice for fewer than 10 years suggest that this gender gap in representation and research productivity may be dissipating. Efforts to customize career pathways and improve mentorship for women entering careers in academic GI are critical to achieving gender equality in the future.

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Figure 3 Depiction of (A) median career duration, (B) median number of publications, (C) median h-index, and (D) median m-index between men and women comprising the top 10% of academic gastroenterologists in the United States, 2014.
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