



Gender Differences in Authorship of Family Medicine Publications, 2002-2017

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BACKGROUND AND OBJECTIVES: Representation of women in medicine is increasing, including in academic family medicine. Despite this, women continue to hold a minority of senior faculty and leadership roles. This study examines the trends of women first and senior authorship between 2002 and 2017 in five family medicine journals: *Family Medicine*, *Journal of Family Practice*, *Journal of the American Board of Family Medicine*, *Annals of Family Medicine*, and *American Family Physician*. The study also examines gender congruence between first and senior authors and women's membership on editorial boards.

METHODS: We collected and analyzed data on a total of 1,671 original articles published in the five family medicine journals in 2002, 2007, 2012, and 2017. We also examined the gender composition of the journals' editorial boards.

RESULTS: Overall, women first authorship increased significantly from 32.6% in 2002 to 47.7% in 2017. There was no significant difference in women senior authorship or editorial board representation from 2002 to 2017. Both men and women senior authors partnered with women first authors significantly more over the 15 years.

CONCLUSIONS: While there was a statistically significant increase in women first authors between 2002 and 2017, there is still a gap between women's authorship and editorial board representation and their representation within academic family medicine. These gaps could help to explain the continued lack of women represented within senior faculty positions.

(Fam Med. 2021;53(6):416-22.)

doi: 10.22454/FamMed.2021.866524

Women face many challenges within the field of medicine, particularly in academic medicine. As in many other professional arenas, gender stereotypes in and out of the workplace, bias, and a lack of mentorship can add barriers to women achieving the same levels of success as men in medicine.

The Association of American Medical Colleges' (AAMC) 2020 publication *The State of Women in Academic*

Medicine highlighted gender disparities present from medical school applications to senior leadership positions.¹ After seeing a decline in women applicants to medical school between 2004 and 2014 from 51% to 46%, the percentage of women applicants rose to 50.9% in the 2018-2019 cycle.^{1,2} Women made up 51.6% of matriculating medical students across the country in 2019.¹ Within the US medical community, women make up 46% of resident physicians,

41% of medical school faculty, and 35% of current active physicians.^{1,3,4}

Women also remain underrepresented in leadership positions both in academic and private institutions.^{1,5} According to the AAMC, in 2018 at US medical schools, women represented only 25% of professors, but 58% of instructors.⁴ Only 18% of department chairs and deans within medical schools were women, up slightly from 16% in 2014.^{1,2}

Publication is essential to academic promotion. A growing body of research published in the past 5 years shows that women across specialties continue to be underrepresented as authors of published original articles in peer-reviewed journals.⁶⁻²⁷ This is referred to as the gender productivity gap. Additional studies show that women encounter more challenges obtaining funding.^{10,28-30} The publications of men also have higher perceived impact as measured by a higher h-index, though removal of self-citations eliminates this disparity.^{31,32} Multiple studies in other fields, including otolaryngology, psychiatry, women's health, and dermatology, demonstrate that women are also underrepresented on editorial boards.³³⁻³⁷

The percentage of women family physicians rose from 30.5% in 2002 to 44% in 2017, a trend that is likely to continue as 54% of family

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medicine residents were women in 2017.^{4,38} Previous research by Schragger et al published in 2011 showed that within a 3-year time frame from 2006 to 2008, only one-third of published original research in family medicine was authored by women, despite comprising 44% of faculty positions.³⁹ A 2019 article by Wright et al showed similar findings among first authors published between 2013 and 2017 in the same family medicine journals: 44% of first authors were women while 49% of family medicine faculty were women.⁸ In 2020, the Robert Graham Center for Policy Studies in Family Medicine and Primary Care published an assessment of the Center's publications over an 11-year span and demonstrated that 34.5% studies had a woman first author, and women last authors represented 13.4% of studies.¹⁷ Most recently, in 2021, Mieses Malchuk et al demonstrated an increase in the proportion of women last authors in three family medicine publications between 2008-2017, and that women last authors were equally if not more likely to partner with women first authors than their male counterparts.¹⁹ Jabbarpour et al showed that while the proportion of first and last authors that are women is increasing over the same 10 year period of 2008-2017, editorial board composition remains stagnant.²⁰

There are a variety of studies that look at gender and authorship in family medicine, some over a point in time, and some longitudinal over a time period up to 10 years. Many include all articles written during the time period; this research focused only on original articles given the importance placed on original, peer-reviewed work for academic advancement.^{18-20,22,24,27}

This study is the first to examine the trajectory of women first authorship, senior authorship, and editorial board membership in family medicine across a 15-year time period including only original articles for all five of the major American family

medicine journals. We chose to examine four points in time over 15 years to see if there were persistent trends. We hypothesized that women's representation within academic journals would steadily increase. With women representing 44% of family physicians³⁸ and 51% of academic family medicine faculty⁴⁰ in 2017, we hypothesized that women's representation within academic journals would mirror those numbers. We chose to focus on first authors, last authors, and editorial boards because this may also reflect a leadership trajectory for women academic family physicians.

Methods

We assessed the prevalence of women and gender congruence between first and senior (last listed) authorship of original articles published in five major North American family medicine journals, and the gender distribution in each of the target journals' editorial boards. We included the journals *Family Medicine* (FM), *Journal of Family Practice* (JFP), *Journal of the American Board of Family Medicine* (JAB-FM), *Annals of Family Medicine* (AFM), and *American Family Physician* (AFP). We included all original articles published in the years 2002, 2007, 2012, and 2017 in the data set. Original articles included original research, brief reports, and reviews, and excluded editorials and reflections. Each journal had slightly different nomenclature for different types of articles, so we created a list of included and excluded article type for each journal. For each article, the date of publication (year and month) and the gender of the first and senior author (woman, man, unknown) were collected. Physicians as well as other members of the academic team were included and we did not record the authors' degrees. We did not include articles by a study group with no listed authors. We listed articles with only one author as a first-authored article only. We chose four 1-year time periods to demonstrate

a trend but keep the scope of work manageable. We modeled our methods on a similar study in *Pediatrics* authored by Fishman et al.²⁷

We coded gender based on the first names of authors. If the name was indeterminate, we visited institutional websites, social media accounts (such as Doximity and LinkedIn), and internet search engines (such as Google) to code the individual's gender identity from pronouns and/or appearance. Recognizing that gender is not biological, we chose to use gender and not sex, and are referring to women and men authors rather than female and male. We did not specifically research whether authors identified as transgender or gender nonbinary. One year of articles from one journal were coded by three members of the research team to come to consensus about the accuracy of this process, however we did not calculate interrater reliability.

We obtained the masthead page from one issue per year of each journal from the four target years from their respective editorial teams and reviewed the gender composition of the journals' editorial boards using the same methodology.

We also collected data about the geographic location of the authors' institution. To be classified as an article based in the United States (US article), at least the first or last author had to be from a US institution. We excluded articles for which neither first nor senior author was in the United States.

In academic medicine literature, the last author frequently is considered the senior author and often holds a more senior academic rank. Traditionally this person may offer expertise, support, and possibly mentorship to the first author. Given the potential significance of the relationship, we examined gender concordance of the first and last author.

The University of Washington Institutional Review Board exempted this research and waived the need for informed consent as it used only publicly available databases.

Statistical Analyses

We coded and stored the data in a Microsoft Excel database and analyzed them using SPSS (v 24.0; IBM Corp, Armonk, New York) to determine the distributions of the gender of first and senior authors in the selected journals. Comparisons between journals, in addition to the effect of senior author gender on first author gender, were examined with χ^2 tests. We used the Cochran-Armitage trend test to evaluate for trend over time. We set significance at a *P* value of .05.

Results

We collected data on a total of 1,671 original articles. Of these, no articles were excluded due to inability to determine the gender of either first or senior author. We coded single authors as first author, and these represented 278 (16.6%) of the articles. Table 1 shows the percentages of first and senior authors who were identified as women overall, by journal, and by year of publication. Overall, 40.7% (680/1,671) of the first authors and 43.1% (600/1,393) of the senior authors were women. Analysis of original article authorship in all five journals combined showed increasing representation

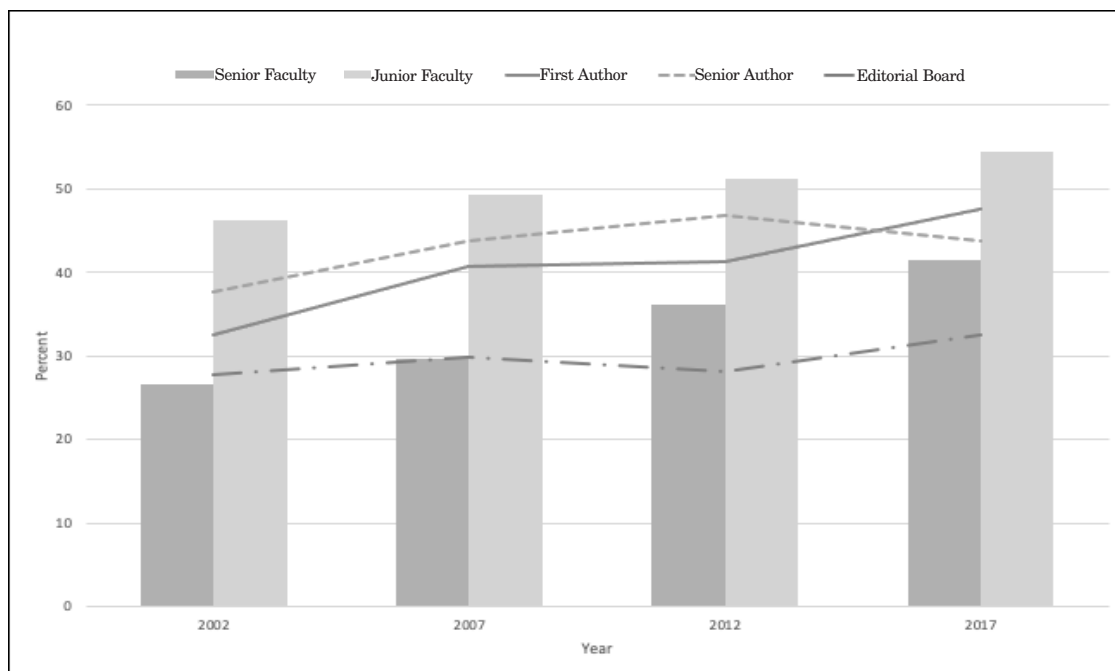
of women first authors in each of the years studied (Figure 1). The proportion of women first authors in the selected journals combined increased from 32.6% (133/408) in 2002 to 47.7% (205/430) in 2017 (*P* for trend <.0001). Analysis of women senior authors demonstrated a statistically nonsignificant increase from 37.7% (122/324) in 2002 to 43.7% (163/373) in 2017, with a peak of 46.8% (162/346) in 2012 (*P* for trend =.088).

Evaluating each journal independently, the proportion of women first authors across all years was highest in FM and lowest in AFM. There was a statistically significant increase in

Table 1: Representation of Women Among First Authors, Senior Authors, and on Editorial Boards Across Five Family Medicine Journals

Variables	2002	2007	2012	2017	P Value*
	Number/Total Number (%)				
Overall					
First author	133/408 (32.6)	174/427 (40.8)	168/406 (41.4)	205/430 (47.7)	<.0001*
Last author	122/324 (37.7)	153/350 (43.7)	162/346 (46.8)	163/373 (43.7)	.0882
Editorial board	30/108 (27.8)	35/117 (29.1)	32/114 (28.1)	37/114 (32.5)	.529
Family Medicine (FM)					
First author	29/74 (39.2)	30/70 (42.9)	39/72 (54.2)	45/79 (57.0)	.0123*
Last author	21/66 (31.8)	25/67 (37.3)	34/72 (47.2)	36/78 (46.2)	.0454*
Editorial board	15/33 (45.5)	13/34 (38.2)	11/31 (35.5)	14/31 (45.2)	.9167
Journal of Family Practice (JFP)					
First author	43/120 (35.8)	42/98 (42.9)	38/95 (40.0)	31/87 (35.6)	.9734
Last author	61/105 (58.1)	58/91 (63.7)	41/72 (56.9)	27/65 (41.5)	.0413*
Editorial board	8/36 (22.2)	6/38 (15.8)	4/25 (16.0)	4/19 (21.1)	.8165
Journal of the American Board of Family Medicine (JABFM)					
First author	15/64 (23.4)	24/55 (43.6)	29/81 (35.8)	50/78 (64.1)	<.0001*
Last author	15/55 (27.3)	17/49 (34.7)	26/74 (35.1)	31/75 (41.3)	.1105
Editorial board	1/25 (4.0)	8/24 (33.3)	7/28 (25.0)	7/29 (24.1)	.1561
Annals of Family Medicine (AFM)					
First author	Not in circulation	14/45 (31.1)	11/30 (36.7)	16/34 (47.1)	.1511
Last author		14/41 (34.2)	7/29 (24.1)	13/33 (39.4)	.6838
Editorial board		2/8 (25)	5/13 (38.5)	6/18 (33.3)	.7702
American Family Physician (AFP)					
First author	46/150 (30.7)	64/159 (40.3)	51/128 (39.8)	63/152 (41.5)	.0742
Last author	25/98 (25.5)	39/102 (38.2)	54/99 (54.6)	56/122 (45.9)	.0005*
Editorial board	6/14 (42.9)	6/13 (46.2)	5/17 (29.4)	6/17 (35.3)	.4865

**P* value for trend (Cochran-Armitage test)

Figure 1: Percent of Women First Authors, Senior Authors, and Editorial Board Members Between 2002-2017⁴⁰

Note: While there was a greater proportion of women senior authors than senior faculty members, there was a smaller proportion of women first authors than junior faculty members. The percentage of women editorial board members was at or below the percent of women senior faculty.

the percentage of women first authors from 2002 to 2017 in FM and JABFM. The proportion of women senior authors across all years was highest in JFP and lowest in AFM. There was a statistically significant increase in the percentage of women senior authors from 2002 to 2017 in FM, JFP, and AFP.

We evaluated the gender distribution of the editorial boards for all five journals for each target year (Table 1, Figure 1). Across all five journals, the representation of women on the editorial boards was 27.8% (30/108) in 2002 and 32.5% (37/114) in 2017, though the trend was not statistically significant (P for trend = .529). Evaluated independently, none of the journals had a statistically significant trend.

We also examined the proportion of women first authors on articles with women senior authors and men senior authors across all journals (Figure 2). Overall women

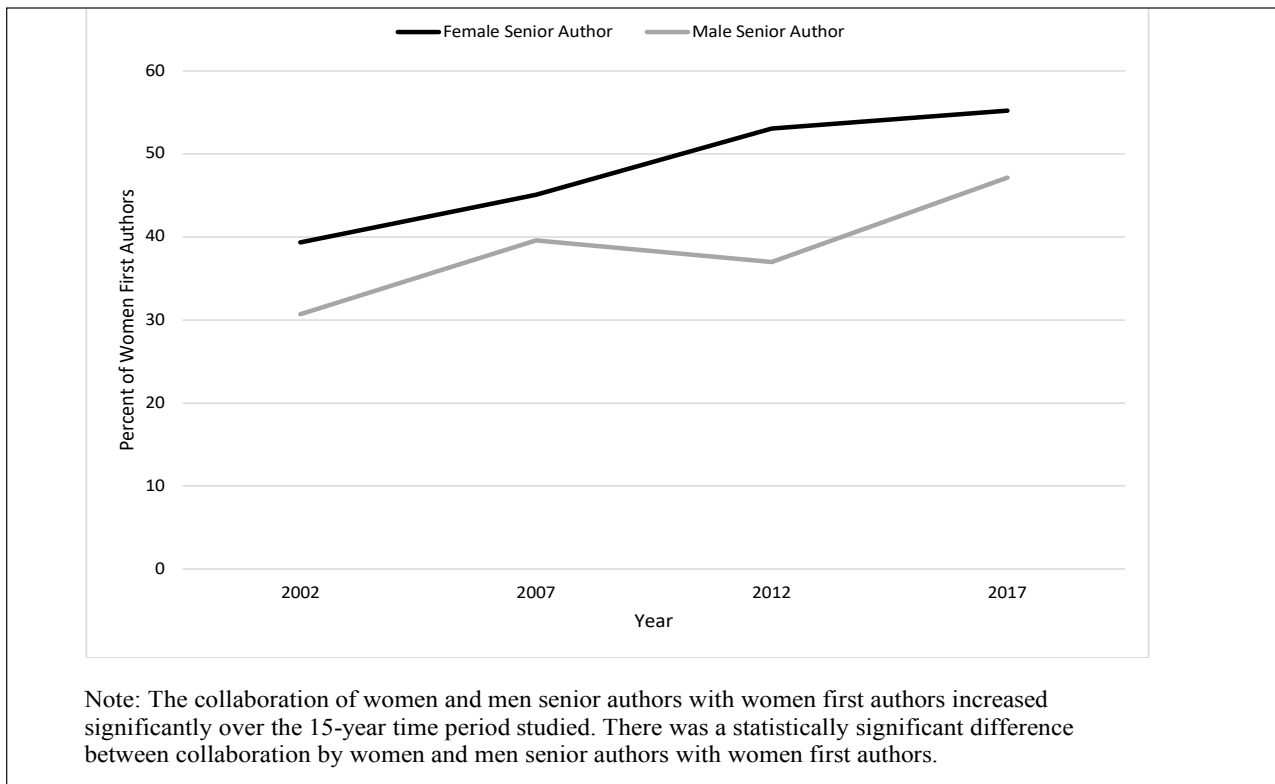
represented 48.8% (293/600) of first authors on articles with women senior authors which was significantly greater than the 38.7% (307/793) of first authors on articles with men senior authors ($P = .0002$). The proportion of women first authors with women senior authors increased significantly from 39.3% (48/122) in 2002 to 55.2% (90/163) in 2017 (P for trend = .003). The proportion of women first authors with men senior authors also increased significantly from 30.7% (62/202) in 2002 to 47.1% (99/210) in 2017 (P for trend = .002).

Discussion

Women as first authors of original articles in the five academic family medicine journals included in this study rose over the past 15 years, nearly matching representation in academic medicine at 48% in 2017.⁴⁰ Women as senior authors and members of editorial boards had a slow and not statistically significant

increase over the 15-year period, and both continue to lag behind the percentage of women in academic family medicine. Our findings are consistent with other studies, both within family medicine and other specialties.^{6,7,16–25,8,26–29,33–37,9–15} This raises the question of why there are not comparable increases in the percentage of women in leadership.⁴⁰

There are signs of a narrowing gap between the genders within academic family medicine: this study shows better representation in senior authorship, which echoes the AAMC data on academic rank (Figure 1).⁴⁰ While women have not reached equal representation as first authors, senior authors, members of editorial boards, or senior faculty, the overall trend narrows the gender gap. Without publication, promotion is hard to achieve. We hope that a narrowing gender gap in authorship will contribute to a narrowing gap in promotion and leadership. Editorial board

Figure 2: Collaboration With Women First Authors

representation also falls short of comparisons among authorship and faculty representation at senior and junior ranks. We note that the pattern of significant increases over time among more junior positions (first author, junior faculty rank) are less meaningful if those changes are not carried through up the ranks to senior author, journal editors, or senior faculty rank. Journals and academic departments must encourage equitable representation at every step to publication, including editorial boards.

When analyzing the relationship between first and senior authors, women senior authors are more likely than men senior authors to collaborate with a woman first author. Knowing that senior authors often offer expertise, support, and possibly mentorship to first authors, this gender concordance suggests that women may seek each other out as collaborators. It is unknown whether women senior faculty are more likely to reach out to junior women faculty or junior faculty women are

more likely to seek mentorship from women colleagues. Continued efforts need to be made to support faculty collaboration across ranks regardless of gender.

Strengths of the Study

This study was able to collect a large amount of data across 15 years, leading to a valuable examination of the trends across time within family medicine journals. Trends over time allow more insight into gender representation than a snapshot in time.

Limitation of the Study

Though this study examined a 15-year trend, it did so through four single-year snapshots in time that may result in missed trends. We also chose to evaluate only original articles and did not study the gender breakdown of authorship of other scholarly contributions, such as narrative pieces and editorials. We recognize that while the relationship between senior and junior authors ideally represents one of support or mentorship, it also may be exploitive

of junior faculty.^{41,42} We also acknowledge that the first and last authors may consider themselves coequal, particularly in publications with a smaller number of named collaborators. Many family medicine faculty also publish in journals outside of the five that were examined here. Our comparison groups do not represent all of the disciplines that are represented among authors in the five target journals; for example, ABFM diplomates do not include behavioral scientists or researchers and AAMC academic medicine faculty do not include all graduate medical education faculty. We performed this study through a binary gender lens and genders were assigned based on names, appearances, and pronouns used on publicly available websites. This study as well as the data provided by governing bodies does not allow further insight into the representation of transgender and gender nonbinary individuals. The primary research team was composed of two women family medicine physicians and a woman medical

student interested in family medicine, though several men contributed to this publication. The nature of this study design does not provide insight into causation; further research is required to assess this. For example, the difference in submission rate of original articles by men and women may be a contributing factor, but was not examined in this study.

Future Research

Areas for continued research include examining the gender impact of editorial board selection process, article submission and review process, and investigating how transgender and gender nonbinary individuals fit into the landscape of authorship and mentorship. To remedy the gender gap in first and senior authorship as well as editorial boards, interventions at all levels will need to be implemented and studied. Finally, obtaining a better understanding of whether publication rates of women and men differ as well as time in rank when applying for similar promotions would allow for a fuller understanding of why women remain underrepresented at senior ranks.

Conclusion

The data in this study only tell part of the story, and raise questions for future research. Similar to research findings within other specialties, the proportion of women as first authors of original articles within family medicine journals over the last 15 years is rising. However, a gap still exists between the proportion of articles authored by women and the proportion of women within academic family medicine, and the increase in women's representation in senior authorship and editorial boards is halting at best. It is important for editorial boards and academic institutions to make a concerted effort to reduce barriers and increase mentorship to promote more gender equity among authorship, editorial boards, and senior faculty positions.

ACKNOWLEDGMENTS: The authors acknowledge Josie Dolan, Lars Peterson, MD, PhD (ABFM), and Susan Peterson for their assistance gathering data for this study. They also acknowledge Lanie Ross, MD, PhD and Michael Fishman, MD for their guidance as we started this study.

FINANCIAL SUPPORT: Tilden Keller received financial support from the Washington Academy of Family Physicians Foundation and the American Academy of Family Physicians Foundation Summer Student Research Externship.

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