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Authors

Weiss, Dana A
Kovshilovskaya, Bogdana
Breyer, Benjamin N

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Gender Trends of Urology Manuscript Authors in the United States: A 35-Year Progression

Dana A. Weiss, Bogdana Kovshilovskaya and Benjamin N. Breyer*

From the Department of Urology, University of California-San Francisco, San Francisco, California

Purpose: The presence of women in urology has gradually increased in the last 35 years with an accelerated rate in the last decade. We evaluated manuscript authorship trends by gender. Manuscript authorship is a metric that has been used as a marker of academic productivity. We hypothesized that the number of first and last author publications by women has increased proportionately to the number of women in the field during the last 35 years.

Materials and Methods: We performed a bibliometric study to examine authorship gender in *The Journal of Urology*® and *Urology*®. We reviewed all original articles published from American institutions in 1974, 1979, 1984, 1989, 1994, 1999, 2004 and 2009.

Results: Of the 8,313 articles reviewed 5,461 were from American institutions, including 97.5% for which we determined author gender. There were 767 articles with female authors, including 440 first and 327 last authors. First and last female authorship increased from 2.7% of all authors in 1979 to 26.5% in 2009 (test for trend $p < 0.001$). This authorship rate surpasses the rate of growth of women in urology, which increased from 0.24% in 1975 to 6.2% in 2008.

Conclusions: Based on authorship gender analysis women urologists produce manuscripts at a rate that exceeds their number in the field. Findings show that women in urology are productive, active members of the academic community.

Key Words: urology; authorship; women; manuscripts, medical; periodicals as topic

HISTORICALLY the vocation of medicine has been a male dominated field. However, in the last 3 decades the number of women entering medicine has steadily increased. In 1980 women comprised 12% of the total physician work force in the United States but by 2006 they accounted for 28%.¹

Despite this increase until recently women remained a small minority in urology and other surgical fields.² In 1928 Dr. Mary E. Childs McGregor (1896 to 1955) was the first woman to complete urology training.³ She subsequently became the first Chief of Urology at New York Infirmary in

New York City. In 1962 Dr. Elisabeth Pickett became the first woman to be board certified in urology 27 years after the American Board of Urology was incorporated.³ In 1975 Dr. Mary Louise Gannon was the first woman elected to the American Urological Association, which was founded in 1902. Women had been eligible to join the American Urological Association since 1954.⁴

During the last 30 years there has been a significant increase in female authorship in the medical literature. Jagsi et al noted that in the last 3 decades there was a general increase

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* Correspondence and requests for reprints: Department of Urology, University of California-San Francisco, 400 Parnassus Ave., A610, San Francisco, California 94143 (telephone: 415-353-2207; FAX: 415-353-5796; e-mail: bbreyer@urology.ucsf.edu).

in female authorship across all fields with a marked increase in obstetrics/gynecology and pediatrics.⁵ A review of authorship trends in dermatology showed that women publish original, peer reviewed articles in a proportion exceeding the number of women in the field.⁶ A similar trend was seen in the otolaryngology literature.⁷

To our knowledge there has been no systematic evaluation of urology publications based on gender to date. It would be valuable to characterize publication trends by women to better understand their academic productivity. We hypothesized that the number of first and last author publications by women has increased proportionately to the number of women in the field.

MATERIALS AND METHODS

Study Population

The study protocol was reviewed and declared exempt by the University of California-San Francisco institutional review board. We selected 2 primary journals of general urology in North America, *The Journal of Urology* and *Urology*, to represent the general urological literature. All articles published in each journal in 1974, 1979, 1984, 1989, 1994, 1999, 2004 and 2009 were reviewed. Only articles from institutions in the United States were included since we evaluated the number of women in urology in the United States.

Country of origin was based on the location of the last author. If the study was a multicenter effort, the country of the corresponding author was used. Article types included in analysis were original manuscripts, review articles, investigative urology and case reports. Excluded articles were editorials, point/counterpoint, special communications, surgeon workshop, preliminary communication, urological history, names in genitourinary surgery, uropathology, uroradiology, uropharmacology and urological survey/abstracts. Supplemental volumes of abstracts from national meetings were also excluded.

Gender Determination

For each article we determined the gender of the first and the last author. Two independent reviewers classified a 6-month block for each year. Gender was determined by common convention. If only initials were listed, a World Wide Web search was done with a Google™ search engine to find the full name of the author. For any name that was potentially gender neutral or ambiguous we sought a biography or picture. If no gender was determined, it was recorded as indeterminate and excluded from final analysis. If an article had a first and a last female author, each author was counted. Our goal was to count the total number of first and last authorships rather than the number of manuscripts authored by women.

To determine the gender characteristics of authorships in the current era we focused on 2009 for more in-depth analysis. For the 24 volumes in 2009 from the 2 journals we recorded the full name of the first and the last author regardless of whether the name was deemed ambiguous, and regardless of the gender assigned and the author

department listed, if available. We also tracked how many individual authors had 2 to 4 or more publications during 2009. This value was assessed for male and female authors. The number of physicians in urology was derived from an American Medical Association publication.¹

Statistical Methods

We used descriptive statistics to characterize the study population. First, last and total authorship counts for men and women were compared across years using the Cuzick nonparametric test for trend across ordered groups.⁸ This test is an extension of the Wilcoxon rank sum/Mann-Whitney test to the ordered category case.

Interreviewer observed agreement was measured by calculating the κ statistic based on an overlapping review of 21 months of publications. Statistical significance was considered at $p < 0.05$ and all tests were 2 sided. STATA® 11 was used for all analysis.

RESULTS

We reviewed 8,313 articles (fig. 1). From *The Journal of Urology* 12 volumes annually for 8 years were reviewed. Of the articles 5,265 met study inclusion criteria, of which 3,420 (64.9%) were from American institutions. Author gender was determined 97% of the time. We assigned female authorship in 504 cases, including first and last author in 279 and 225, respectively. There were 26 articles with first and last female authors. In 1974 there were 1.9% female first authorships and 1.7% female last authorships of the total number of manuscripts. By 2009 there were 20.8% first and 12.4% last authorships.

Similarly in *Urology* 12 volumes annually were reviewed for 8 years. Of the 3,055 articles initially included 2,041 (66.8%) from American institutions were analyzed for author gender, which was determined in 98.4%. We assigned female authorship in 263 cases, including first and last author in 161 and 102, respectively. There were 22 articles that had first and last female authors. In 1974 there were 0.96% female first authorships and 0.59% female last authorships. By 2009 there were 16.7% first authorships and 8.5% last authorships (fig. 1).

Overall in 1974 women comprised 1.5% and 1.2% of first and last authorships while by 2009 the number had increased to 16.7% and 9.8%, respectively. Conversely in 1974 there were 98.5% and 98.9% male first and last authorships, which decreased to 83.3% and 90.2%, respectively, by 2009 (see table and fig. 2). The table also shows that in 1974 and 1979 there were more authorships by women than women in urology, indicating that the same women wrote multiple manuscripts. As time passed, the proportion of authorships compared to the number of women in urology appropriately decreased as the number of women in the field increased. For men in

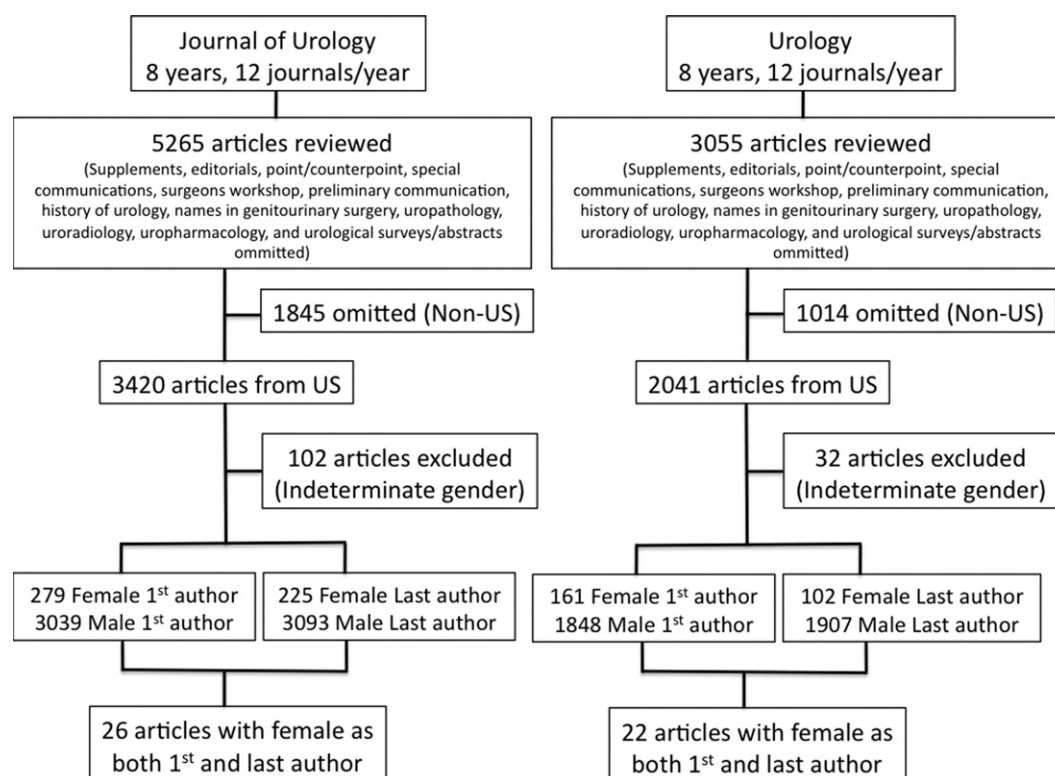


Figure 1. Study flowchart

urology the ratio of authorships to urologists plateaued at around 14% in the mid 1980s with a slight decrease in 2009.

From 1975 to 2008 the number of women urologists increased from 16 of 6,667 urologists to 652 of 10,493. During that time there was a significant increase in first, last and total number of female authors ($p < 0.001$, [fig. 3, A](#)). Although the number of men in urology also increased from 6,651 to 9,841 during that period, there was a slight but statistically significant decrease in the number of first and last authorships ($p < 0.001$, [fig. 3, B](#)). The proportion

of women first authors/woman urologists has been greater than that of men first authors/men in urology during the last 35 years ([fig. 3, C](#)). Moreover, while the total number of male first authors remains greater than that of female first authors, this discrepancy decreased with time ([fig. 3, D](#)).

Interreviewer observed agreement for gender assignment was strong with agreement in 98.52% of observations ($\kappa = 0.913$, 95% CI 0.854–0.973). We commonly used gender verification during the classification process. For example, in 2009, 149 of 1,168 author names (12.7%) required gender confirmation,

Authorship characteristics

	No. 1974 (%)	No. 1979 (%)	No. 1984 (%)	No. 1989 (%)	No. 1994 (%)	No. 1999 (%)	No. 2004 (%)	No. 2009 (%)
<i>Women</i>								
In urology	16	39	98	134	244	334	508	652
Authors/urologists	(112.5)	(110.3)	(57.1)	(61.9)	(33.2)	(44.6)	(34.8)	(24.5)
Overall authors:	18	43	56	83	81	149	177	160
1st	10 (1.5)	14 (2.3)	24 (3.8)	42 (7.5)	43 (6.2)	98 (12/7)	108 (13.7)	101 (16.7)
Last	8 (1.2)	29 (4.7)	32 (5.1)	41 (7.4)	38 (5.4)	51 (6.6)	69 (8.8)	59 (9.8)
1st + Last	2	1	1	3	4	6	16	15
<i>Men</i>								
In urology	6,651	7,704	8,738	9,238	9,642	9,968	10,060	9,841
Authors/urologists	(19.5)	(15.5)	(13.8)	(11.2)	(14)	(14)	(13.9)	(10.6)
Overall authors:	1,296	1,193	1,210	1,031	1,350	1,395	1,399	1,048
1st	647 (98.5)	604 (97.7)	609 (96.2)	515 (92.5)	655 (93.8)	674 (87.3)	680 (86.2)	503 (83.3)
Last	649 (98.8)	589 (95.3)	601 (94.9)	516 (92.6)	660 (94.6)	721 (93.4)	719 (91.2)	545 (90.2)
1st + Last	655	617	632	554	695	766	772	589

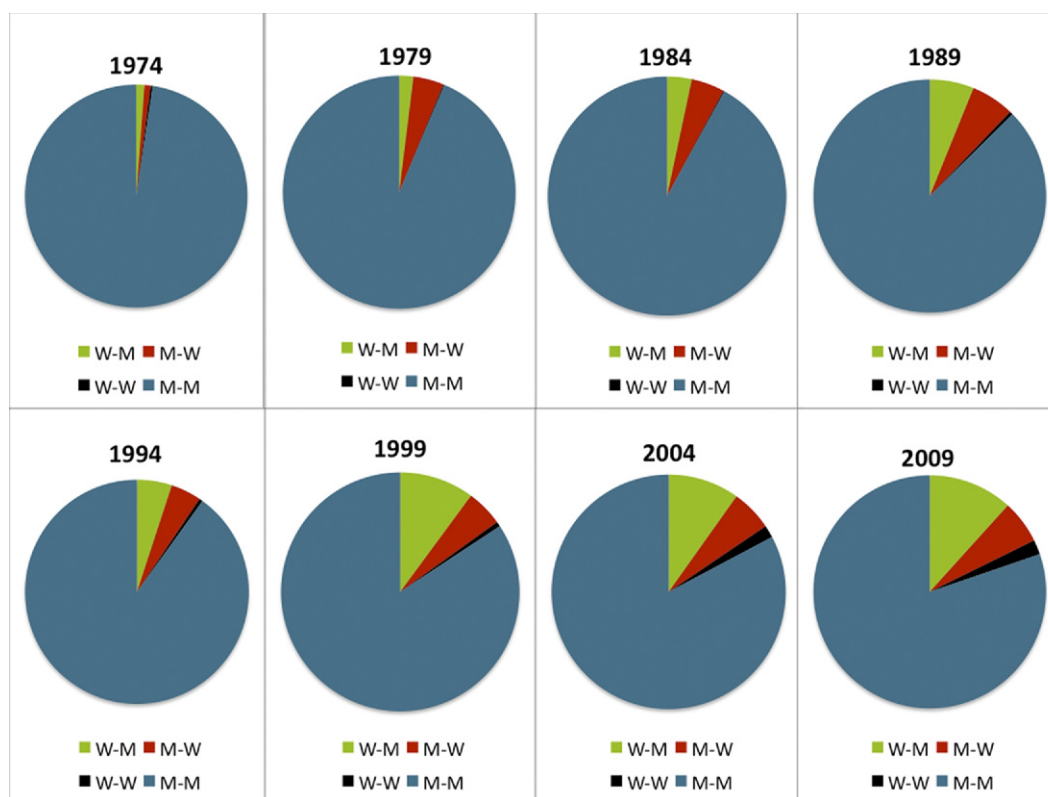


Figure 2. Author gender during last 35 years. *W-M*, female first author. *M-W*, female last author. *W-W*, female first and last author. *M-M*, male first and last author.

of which 15 (1.3% of the total) were deemed indeterminate.

Author gender determination was done for each publication. Thus, we counted each author several times if that author had published more than 1 manuscript in any year. Based on 2009 data we determined how many male and female authors published more than 1 manuscript annually in each journal. In 2009 of the 160 female first and last authorships 8 authors had 2 publications each and only 2 had 3 each. Of the 1,048 male authorships 122 authors had 2 or more publications, 39 had 3 or more and 12 had 4 or more.

DISCUSSION

More women are becoming urologists, which parallels trends in other surgical subspecialties.⁹ We evaluated female authorship trends during the last 35 years in the United States to determine whether they parallel the number of women in the field. The number of first and last female author publications in 2 popular general urology journals increased with time. Conversely while the number of men in urology has also grown publication trends by males did not show a similar increase.

Since the number of women in urology has grown faster than the number of authors, the proportion of

female authors to female urologists has decreased with time. Also, the overall ratio of female authorships to urologists exceeded that of male authorships to male urologists during the same period (fig. 3, C). The ratio of male first and last authors to urologists has been approximately stable at around 14% since the 1980s with only a small decrease in 2009. This stable value shows a minimal change in the overall productivity of men during the last 2 decades, accentuating the change in trends in women during the same period. Subsequent years must be evaluated to indicate whether the decrease in 2009 will become durable or whether it was a 1-year aberration. These findings corroborate recent reports from other subspecialty fields, including otolaryngology,⁷ dermatology⁶ and emergency medicine,¹⁰ which show that the number of publications by women is in proportion to or even greater than the overall number of women in the field.

By more extensively evaluating 2009 we determined whether a few urologists accounted for the total number of publications or whether the publications were produced by a wide range of physicians. More men publish 2 or more manuscripts annually and even up to 4 or 5. This may indicate that there may be proportionately fewer men in urology who are academically productive than would appear just

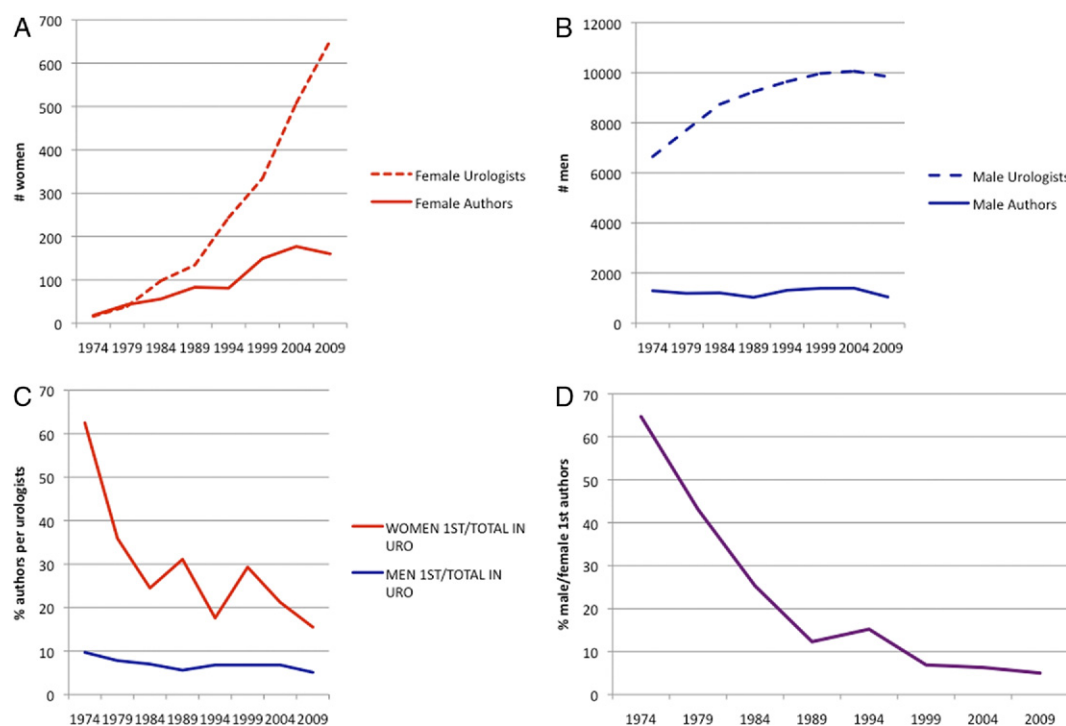


Figure 3. A, female author and female urologist trends. B, male author and male urologist trends. C, proportion of first authors to number of urologists by gender. URO, urology. D, ratio of male to female first authors.

by looking at the total number of publications vs the number of urologists. By accounting for multiple manuscripts in 2009 we found that the 1,048 male manuscript authorships actually comprised only 811 men. For women 160 manuscript authorships comprised 143 individuals. This reveals that the academic productivity of women in recent years has not been dominated by a few prolific authors but rather was spread over many individuals.

Our findings specifically showed a greater increase of first vs last authorship in the last 15 years. This may have been due to the influx of female residents in urology, who would have a first author role. This proportion may equilibrate in the future as more females become senior authors. A similar pattern was observed in a study from the United Kingdom, in which the medical literature during the last 3 decades was reviewed and a steeper increase in female first authors than in senior authorship was noted during the last 10 years.¹¹

This study has several limitations. Our study sample included only 2 general urology journals, excluding specialty journals and general medicine journals that may have urology specific manuscripts. However, these are the 2 primary urology journals in the United States and they provide a publication record representing the period of interest. Also, since we did not separate the articles reviewed by topic, we could not determine whether women are more or less involved in certain urology

subspecialty fields, such as infertility or oncology. Using the first name to determine author gender is also a limitation. We made an effort to look up any name that was not universally considered a gender specific name and any authors for whom we could not determine a gender were omitted from analysis.

Another limitation is that we did not separate physician vs nonphysician authors or physician authors from those from other fields, such as medicine and surgery. Hence, some first authors may have been students who entered other medical fields, physicians from other fields or nonphysician authors. This may have created a discrepancy when looking at the ratio of authors compared to total urologists since the number of authors who were presumably urologists may have been falsely increased. Moreover, we based nationality on the last author location so that foreign fellows working in departments in the United States would have been counted with the overall number of American authors but not with the overall number of urologists in the United States. Lastly, we did not assess manuscript quality through citation analysis with metrics such as the h-index.¹²

Based on authorship gender analysis to our knowledge we report the first study revealing that women in urology produce manuscripts at a level that mirrors their number in the field. While this is a single metric of academic productivity, manuscript authorship is critical to peer recognition, academic

promotion and advancement of the field. Our findings help show that women in urology are productive, active members of the academic community.

CONCLUSIONS

To our knowledge we report the first study of the publication rate of women in urology, a surgical subspecialty that has seen a dramatic increase in

women entering the field. Since 1974, the number of first and last female author publications has increased significantly with time. Future investigations should evaluate the citation index of publications to estimate the impact of articles written by women. Also, further analysis of subspecialty journals could provide valuable information on the contributions of women in the various subdisciplines of urology.

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