
Gender differences in promotions and scholarly productivity in academic urology

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Introduction: The gender demographics within urology are changing as more women are entering the workforce. Since research productivity strongly influence career advancement, we aim to characterize gender differences in scholarly productivity and promotions in a cohort of graduated academic urologists.

Materials and methods: Urologists who graduated between 2002 and 2008 from 34 residency programs affiliated with the top 50 urology hospitals as ranked in 2009 by U.S. News & World Report were followed longitudinally. Only urologists affiliated with an academic teaching hospital were included for analysis.

Results: A total of 543 residents graduated, 459 (84.5%) males and 84 (15.5%) females. Of these, 173 entered academia, 137 (79.2%) males and 36 (20.8%) females.

Women had fewer publications compared to men (mean 19.3 versus 61.7, $p = 0.001$). Fewer women compared to men were promoted from assistant professor 11 (30.6%) versus 83 (60.6%), $p = 0.005$. Fewer women achieved associate professor 10 (27.8%) versus 67 (48.9%), $p = 0.005$ or professor ranks 1 (2.8%) versus 16 (11.7%), $p = 0.005$ respectively compared to men. In a multivariate logistic regression analysis, after controlling for the number of total publications and number of years since graduation, gender was not predictive of achieving promotion, OR = 0.81 (95% CI 0.31-2.13), $p = 0.673$.

Conclusions: Women are underrepresented in senior faculty roles in urology. Scholarly productivity seems to play a major role in academic promotion within urology. With increasing women in academic urology, further studies are needed to explore predictors of promotion and how women can achieve higher leadership roles in the field.

Key Words: urology, promotion, academic rank, gender

Introduction

Promotion in academic medicine relies on several factors, including medical education, administrative

responsibilities, faculty member clinical performance, and research productivity.¹ Research productivity remains one of the most paramount factors for academic promotion.² Gender differences in academic productivity and promotion have been documented in medicine.³⁻⁷ In 2011, only 13% of women in academic medicine have achieved the rank of full professors. Despite the fact that some improvements have been reported, all faculty or leadership positions have a greater percentage of men compared to women.⁸

Over the past decade more women are choosing urology as a career, which has traditionally been a

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male-dominated medical specialty. In 1995, women comprised only 4.2% of urology residents and 1.2% of board certified urologists.⁹ In 2016, 21.4% of the matched residents were women.¹⁰ In addition, the latest American Urological Association (AUA) census showed that 8% of practicing urologists are currently women in the United States (US).¹¹ Similarly, women constitute 10% of practicing urologists in Canada.¹² Although the percent of women physicians is increasing within urology, women remain underrepresented in the specialty, especially since women patients constitute 30% of a general urologists' practice.¹³

With underrepresentation of women in urology, gender inequalities in the workforce might arise. Documenting and understanding gender disparities in promotion within academic urology is vital to the health and future of the field, especially since a shortage of urologists is predicted in the future.¹⁴ Previously, our group found that men produced more research than their women counterparts during residency, and they achieved more associate professor rank in the first 3 to 9 years in their academic careers.¹⁵ We now revisit the cohort 5 years later with the goal of examining publications and promotions from a longitudinal cohort of residency graduates who entered academic urology. We hypothesize that gender disparities in publication rates and promotion exist, and publication rates strongly influence promotion in both genders. Recognizing these disparities may help determine training or mentoring deficiencies and improve the retention of women in urology.

Materials and methods

Study population

We compiled a list of urology residency programs affiliated with the top 50 urology hospitals as ranked in 2009 by U.S. News & World Report (www.health.usnews.com), which included 37 residency programs. The names of residents who graduated from these programs from 2002 through 2008 were obtained from either program websites (54%) or from the program director(s) (46%). Three programs were excluded due to refusal to provide names of graduated residents. We confirmed that surnames of women did not change since graduation from their updated institutional websites. The original cohort included 543 graduate residents, 459 (84.5%) males and 84 (15.5%) females. In this study we included the 173 residents who pursued an academic career after graduation, which comprised 137 (79.2%) males and 36 (20.8%) females. An academic career was defined as having either a full or part time appointment with a major teaching university hospital.

The study was approved by the institutional review board at University of California, San Francisco.

Predictor variables

From departmental websites, we obtained gender, graduation year, fellowship type and academic career status. We collected publication output via internet searches on PubMed. We used multiple search terms to capture all permutations of names including 1) full name, 2) last name plus first and middle initial, 3) last name plus first initial and 4) last name plus first initial plus "urology". Only publications that were affiliated with an institution at which the urologist had worked were included for analysis. Each publication was reviewed by two independent reviewers to determine the type (original research, review article, case report or editorial comments) and order of authorship (first, middle or last).

Introduced in 2005 by Hirsch et al, h-index is a measure of the number of highly impactful papers an author has published. It is defined as the number of publications (h) that have been each cited at least (h) number of times in the literature.¹⁶ We collected the h-index for each individual through Google scholar h-index calculator.¹⁷ We used the first name plus middle initial plus last name of each urologist to query h-indices.

We collected the number of National Institute of Health (NIH) grants through publically available research portfolio online reporting tools (report.nih.gov), using first and last names of urologists in our study.

Outcome variables

We queried academic urologists' university websites to collect academic ranks (promotion) defined as either assistant professor, associate professor or professor ranks.

We also sought to develop a directed acyclic graph (DAG) for other variables that could affect the association between gender and promotion, and could be used for future research.

Statistical analysis

Data were analyzed using STATA v14 (College Station, TX, USA). We used Pearson chi-square tests to analyze categorical variables and t-tests to analyze continuous variables. Univariate logistic regression was used to evaluate predictors for academic promotion (yes/no). Confounding variables were determined a priori and included into the multivariate model (gender, total publications and number of years since graduation). All tests were two-sided and a p-value of ≤ 0.05 was considered statistically significant.

TABLE 1. Gender differences among academic urologists who graduated between 2002 and 2008

	Males n = 137 (79.2%)	Females n = 36 (20.8%)	p value
Mean number of publications (95% confidence interval)			
Total	61.7 (48.9-74.4)	19.3 (12.5-26.1)	0.001
1 st author	18.2 (14.9-21.5)	7.6 (4.9-10.4)	0.002
Last author	19.1 (14.2-24.1)	3.4 (1.4-5.5)	0.002
Original research	51.2 (40.3-62.1)	15.4 (9.2-21.7)	0.001
H-index	21.6 (19.5-23.7)	10.3 (8.1-12.5)	< 0.001
Mean number of years since graduation	9.8 (9.5-10.1)	9.5 (8.8-10.2)	0.430
NIH grants	19 (13.9)	1 (2.7)	0.063
No. of urologists with grants (%)			
Academia ranks in 2015 (%)			0.005
Assistant professor	54 (39.4)	25 (69.4)	
Associate professor	67 (48.9)	10 (27.8)	
Professor	16 (11.7)	1 (2.8)	
Joined academia (%)	8 (5.8)	8 (22.2)	0.003
Left academia since 2008* (%)	20/149 (13.4)	6/34 (17.7)	0.520

*the number of urologists who left academia out of the total number in academia in 2008

Results

At the time of the study, women had significantly fewer publications of all types (i.e. original research, review articles, case reports and editorial comments) and had a lower mean number of first author publications (7.6 versus 18.2, $p = 0.002$) and last author publications (3.4 versus 19.1, $p = 0.002$). Women also had lower mean

h-indices compared to men (10.3 versus 21.6, $p < 0.001$), and fewer NIH grants 1 (2.7%) versus 19 (13.9%), $p = 0.063$, Table 1.

A higher proportion of women were found to be assistant professors compared to men, 25/36 (69.4%) versus 54/137 (39.4%), and fewer women achieved associate professor rank, 10/36 (27.8%) versus 67/137 (48.9%), and professor rank, 1/36 (2.8%) versus 16/137

TABLE 2. Univariate and multivariate logistic regression for academic promotion

	Univariate OR (95% CI for OR)	p value	Multivariate OR (95% CI for OR)	p value
Gender*	0.29 (0.13-0.63)	0.002	0.81 (0.31-2.13)	0.673
Total publications*°	1.51 (1.31-1.75)	< 0.001	1.56 (1.32-1.84)	< 0.001
First author publications	1.07 (1.04-1.11)	< 0.001		
Last author publications	1.16 (1.09-1.23)	< 0.001		
Original research	1.05 (1.02-1.06)	< 0.001		
H-index	1.18 (1.11-1.24)	< 0.001		
Years since graduation*	1.37 (1.17-1.62)	< 0.001		
Fellowship	1.49 (0.65-3.45)	0.347		

OR = odds ratio; CI = confidence interval

*added to the multivariate model

°having 10 more publications

(11.7%), $p = 0.005$. Since our previous study in 2011, a higher proportion of women joined academia than men, 8 (22.2%) versus 8 (5.8%), $p = 0.003$, and a higher proportion of women left academia compared to men 6 (17.7%) versus 20 (13.4%), but this was not statistically significant, Table 1.

Univariate logistic regression was used to determine which factors predict promotion. Total publications, first and last author publications, original research, h-index, and publications velocity all showed statistically significant association with promotion. Women were less likely to achieve academic promotion compared to men, odds ratio (OR) = 0.29 (95% CI, 0.13-0.63) $p = 0.002$. In a multivariate logistic regression analysis, after controlling for the number of total publications and number of years since graduation, gender was not predictive of achieving promotion, OR = 0.81 (95% CI 0.31-2.13), $p = 0.673$. After controlling for gender and number of years since graduation, for every 10 publications, the odds of promotion increased by 1.56 (95% CI, 1.32-1.84) $p < 0.001$, Table 2.

Discussion

Our prior work demonstrated that women produced fewer publications than men during residency but were more likely to undergo fellowship training and choose an academic career.¹⁵ Other studies have also reported that more women urologists are undergoing fellowship and are choosing an academic career compared to men.^{18,19} Here, we report that in the first 7 to 13 years after graduation, female academic urologists published fewer papers than their male counterparts and were less likely to be promoted.

Research publication output is one of the quantitative measures of academic productivity. A recent bibliometric study done by Weiss et al showed that, from 1974 to 2009, in two peer reviewed urology journals, women authorship has exceeded their growth in the field, while men's authorship was relatively stable.²⁰ Here in a direct comparison of recent resident graduates, we found women published fewer papers than men. While quantifying papers does not gauge quality and impact, h-index is intended to judge a scholar's work beyond quantity.¹⁶ We found on average that women urologists had lower h-indices compared to men.

Urology has and remains among the most male-dominated specialties. Several other male-dominated specialties, such as neurosurgery, plastic surgery, ophthalmology, anesthesiology, and otolaryngology have examined gender disparity.³⁻⁷ These studies have shown that women have less scholastic productivity than men earlier in their career, which is consistent

with our results. Longer follow up is needed among our cohort to determine if women will surpass men in publication output. Within ophthalmology, otolaryngology, and anesthesiology, it has been reported that women had equivalent or increased research output compared to men later in their careers.³⁻⁵

This finding could be explained by familial obligations for women early in their career, such as childbearing and child rearing responsibilities.²¹ An NIH-funded survey study done by Lerner et al showed that women urologists have fewer children and they deliver their children 7-8 years later than national averages.²² In addition, the authors report that, due to different work related pressures, 70% of women urologists have less than 8 weeks of maternity leave,²³ even though the Family and Medical Leave Act (FMLA) allows mothers 12 weeks unpaid leave per 12 month period.²⁴

Another explanation for differing publication output is that women spend more time dedicated to teaching and mentoring compared to men. A survey study by Misra et al showed that women at the associate professor level spend around 8 hours more per week compared to men on teaching, advising and service, while men spend around 7.5 hours more on research.²¹ Furthermore, more women may prefer choosing an educational track for their career rather than a research track; as a result, publishing may not be as strongly emphasized. Although academic tracks were not measured in our study, further work is needed to identify gender gaps in this area.

Prior reports by the Association of American Medical Colleges demonstrate that women required more time to achieve associate professor rank than men (6.5 versus 6.2 years) and more time to achieve professor rank (6.4 versus 6.1 years).²⁵ Although the average time to promotion was not quantified in our study due to varying availability of promotion dates from university websites, we found that around 69.4% of women and 39.4% of men were not promoted over a 7 year period. The degree to which this disparity can be attributed to objective differences in total publications remains to be determined. These differing rates of career advancement between men and women are concerning, especially since more women are proportionally entering into academic medicine. It is possible that women trainees are not "groomed" for tenure-track academics in the same way as men. In addition, the committee of appointment and promotions may be biased toward focusing on publications/grants at the expense of educational productivity during the promotion process.

We reviewed the number of NIH grants as an additional measure of academic productivity. We found that fewer women are principle investigators on NIH grants compared to men, however the difference did not reach statistical significance, given the very low numbers of female principle investigators (only one). These results are consistent with results in other surgical fields like ENT.²⁶ Understanding the implications and why these differences are present are crucial for the future of women in the field. Lack of women in leadership roles may act as a barrier for young academic females and affect their advancement. The creation of mentoring programs across the United States for junior female faculty is an attempt to close the gender gap by utilizing the traditional model of guidance that worked with men.²⁷ We believe that more mentoring should be addressed to female urology residents, and faculty females should participate in career development programs which have shown to increase retention of women in academia.²⁸ If women are retained more in academia, they can serve as mentors, expert teachers, role models and be promoted to higher ranks.

Gender discrimination may play a role in promotion as well, but this factor was not measured. Among American surgeons, 23% of respondent women reported via a survey that their gender was felt to be a barrier in their career development.²⁹ Similarly, in another survey study among female Canadian surgeons, 17% felt fair amount, great or very great deal of discrimination in their career advancement.³⁰

Our study has several limitations. Academic ranks were collected through institutional websites, which may not be up to date at the time of investigation. Such inaccuracy, however, should be gender neutral and thus should not impact our results overall. We only included graduates from the top 50 ranked hospitals. This was thought to capture graduates who will most likely choose an academic career. However, this may not represent the whole population of graduates. Our follow up period was from 7-13 years after residency graduation. A longer follow up may yield changes in research output by gender as seen in many other specialties.³⁻⁵ We only included NIH grants and did not measure other grants, such as foundational and institutional grants. However, it should be emphasized that NIH grants are considered “gold standard” for clinical biomedical and basic science research in the United States, and have been found to have strong relationship with scholarly productivity.³¹ Lastly, our analysis did not include different possible mediators that could be added in a multivariate analysis such as academic tracks (e.g. clinical, research and educational

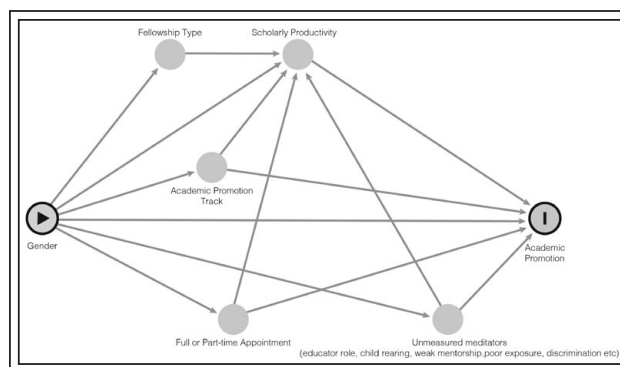


Figure 1. Directed acyclic graph (DAG) showing mediators for the relationship between gender and promotion.

tracks) and whether academics were practicing full or part-time jobs as academics, family leave and child rearing responsibilities, teaching, mentoring and patient-care which may influence time to promotion. These possible mediators were included in our proposed directed acyclic graph (DAG) for future studies shown in Figure 1. Future research should explore potential reasons for the gender gap in academic urology.

Conclusion

Although proportionately more women enter academic urology, they are underrepresented in senior faculty roles. Scholarly productivity seems to play a major role in academic promotion within urology in both genders. With increasing numbers of women in academic urology, further studies are needed to explore predictors of promotion and women can achieve higher leadership roles in the field. □

References

1. Atasoylu AA, Wright SM, Beasley BW et al. Promotion criteria for clinician educators. *J Gen Intern Med* 2003;18(9):711-716.
2. Baldwin C, Chandran L, Gusic M. Guidelines for evaluating the educational performance of medical school faculty: priming a national conversation. *Teach Learn Med* 2011;23(3):285-297.
3. Eloy JA, Svider P, Chandrasekhar SS et al. Gender disparities in scholarly productivity within academic otolaryngology departments. *Otolaryngol Head Neck Surg* 2013;148(2):215-222.
4. Lopez SA, Svider PF, Misra P et al. Gender differences in promotion and scholarly impact: an analysis of 1460 academic ophthalmologists. *J Surg Educ* 2014;71(6):851-859.

5. Pashkova A, Svider P, Chang C et al. Gender disparity among US anaesthesiologists: are women underrepresented in academic ranks and scholarly productivity? *Acta Anaesthesiol Scand* 2013; 57(8):1058-1064.
6. Tomei KL, Nahass MM, Husain Q, et al. A gender-based comparison of academic rank and scholarly productivity in academic neurological surgery. *J Clin Neurosci* 2014;21(7):1102-1105.
7. Paik AM, Mady LJ, Villanueva NL et al. Research productivity and gender disparities: a look at academic plastic surgery. *J Surg Educ* 2014;71(4):593-600.
8. Jolliff L, Leadley J, Coakley E et al. Women in US academic medicine and science: statistics and benchmarking report 2011–2012. Washington, DC: Association of American Medical Colleges, 2012:1-59.
9. Bradbury CL, King DK, Middleton RG. Female urologists: A growing population. *J Urol* 1997;157(5):1854-1856.
10. 2016 Urology Residency Match – Statistics. September 1, 2016]; Available from: <http://www.auanet.org/common/pdf/education/specialty-match/Urology-Residency-Match-Statistics-2016.pdf>.
11. The State of the Urology Workforce and Practice in the United States 2015. September 1, 2016]; Available from: <https://www.auanet.org/common/pdf/research/census/AUA-Census-2015-State-of-the-Urology-Workforce-and-Practice-in-the-United-States.pdf>.
12. Urology Profile - Canadian Medical Association. February 20th, 2017]; Available from: <https://www.cma.ca/Assets/assets-library/document/en/advocacy/profiles/urology-e.pdf>.
13. McDevitt RC, Roberts JW. Market structure and gender disparity in health care: preferences, competition, and quality of care. *The RAND Journal of Economics* 2014;45(1):116-139.
14. Gaither TW, Awad MA, Fang R et al. The near future impact of retirement on the urologic workforce: results from the AUA census. *Urology* 2016;94:85-89.
15. Yang G, Villalta JD, Weiss DA et al. Gender differences in academic productivity and academic career choice among urology residents. *J Urol* 2012;188(4):1286-1290.
16. Hirsch JE. An index to quantify an individual's scientific research output. *Proc Natl Acad Sci U S A* 2005;102(46):16569-16572.
17. Bece A, Patanjali N, Jackson M et al. High-dose-rate brachytherapy boost for prostate cancer: Outcomes and genitourinary toxicity. *Brachytherapy* 2015;14(5):670-676.
18. Spencer ES, Deal AM, Pruthi NR et al. Gender differences in compensation, job satisfaction and other practice patterns in urology. *J Urol* 2016;195(2):450-455.
19. Lightner DJ, Terris MK, Tsao AK et al. Status of women in urology: based on a report to the Society of University Urologists. *J Urol* 2005;173(2):560-563.
20. Weiss DA, Kovshilovskaya B, Breyer BN. Gender trends of urology manuscript authors in the United States: a 35-year progression. *J Urol* 2012;187(1):253-258.
21. Misra J, Lundquist J, Holmes ED et al. Associate professors and gendered barriers to advancement. Amherst, MA: University of Massachusetts, 2010.
22. Lerner LB, Stolzmann KL, Gulla VD. Birth trends and pregnancy complications among women urologists. *J Am Coll Surg* 2009; 208(2):293-297.
23. Lerner LB, Baltrushes RJ, Stolzmann KL et al. Satisfaction of women urologists with maternity leave and childbirth timing. *J Urol* 2010;183(1):282-286.
24. Baum CL. The effect of state maternity leave legislation and the 1993 Family and Medical Leave Act on employment and wages. *Labour Economics* 2003;10(5):573-596.
25. Liu CQ, Alexander H. Promotion rates for first-time assistant and associate professors appointed from 1967 to 1997. *AAMC Analysis in Brief* 2010;9(7).
26. Eloy JA, Svider PF, Kovalerchik O et al. Gender differences in successful NIH grant funding in otolaryngology. *Otolaryngol Head Neck Surg* 2013;149(1):77-83.
27. Richman RC, Morahan PS, Cohen DW et al. Advancing women and closing the leadership gap: the Executive Leadership in Academic Medicine (ELAM) program experience. *J Womens Health Gen Based Med* 2001;10(3):271-277.
28. Chang S, Morahan PS, Magrane D et al. Retaining faculty in academic medicine: the impact of career development programs for women. *J Womens Health* 2016;25(7):687-696.
29. Cochran A, Hauschild T, Elder WB et al. Perceived gender-based barriers to careers in academic surgery. *Am J Surg* 2013;206(2): 263-268.
30. Ferris LE, Mackinnon SE, Mizgala CL et al. Do Canadian female surgeons feel discriminated against as women? *CMAJ* 1996;154(1):21.
31. Svider PF, Mauro KM, Sanghvi S et al. Is NIH funding predictive of greater research productivity and impact among academic otolaryngologists? *Laryngoscope* 2013;123(1):118-122.