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Gender Imbalance at Academic Plastic Surgery Meetings

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Abstract

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Background: Participation in scientific meetings yields multiple benefits, yet participation opportunities may not be equally afforded to men and women. Our primary goal was to evaluate the representation of men and women at five major academic plastic surgery meetings in 2017. Secondarily, we used bibliometric data to compare academic productivity between male and female physician invited speakers or moderators.

Methods: We compiled male and female invited speakers from meeting programs. Bibliometric data (h-index, m-value) and metrics of academic productivity (numbers of career publications, publications in 2015-2016, career peer-reviewed publications, first and senior author publications) for invited speakers were extracted from Scopus and analyzed.

Results: There were 282 academic physician invited speakers at the five 2017 meetings. Women comprised 14.5%. Univariate analysis showed no differences in h-index, m-value, or numbers of total career publications or first and last author publications at the Assistant and Associate Professor ranks, but higher values for men at the Professor level. A model of academic rank based on bibliometric and demographic variables showed male gender significantly associated with increased probability of holding a Professor title, even when controlling for academic achievement markers (OR=2.17, 95% CI: 1.61 to 2.92).

Conclusions: Although the impact of women's published work was no different than that of men among junior and mid-career faculty, women comprise a minority of invited speakers at academic plastic surgery meetings. Sponsorship is imperative to achieve gender balance within our specialty and to ultimately create more diverse and effective teams to improve patient care.

Introduction

Plastic and reconstructive surgery is an innovative field in which research and clinical practice are constantly evolving. Scientific meetings within our subspecialty are important platforms to showcase research discoveries, best practices, and clinical care advances. For practitioners at every stage of training and faculty appointment, these meetings not only provide opportunities to learn cutting-edge innovations, but also encourage idea exchange with colleagues and facilitate networking. Importantly, meeting attendance allows individuals to gain recognition, or "visibility," within the field.

Visibility is an important metric, which can influence the perceived quality of a researcher or clinician.^{1,2} Aside from publications, grants, and awards, visibility can be achieved via participation in conferences, presentations, and engagement with the media.¹ Unfortunately, studies show that visibility and opportunities surrounding meeting participation may not be equally available for all who seek them—and note a gender disparity favoring men.^{1,3,4} Gender discrepancies at scientific meetings are common and have been described in all scientific disciplines.^{1,2,4,5} In a study of invited speakers at neuroimmunology conferences, for example, 66% of the conferences invited fewer females than males, despite equal qualifications, research impact factors, and bibliometric data between genders.⁴ Even among female-dominated fields, such as physical anthropology, men dominate conference visibility.⁶

The primary goal of our study was to evaluate the representation of men and women at five major academic plastic surgery meetings in 2017: Annual Combined American Association

for Hand Surgery (AAHS)/American Society for Peripheral Nerve (ASPN)/American Society for Reconstructive Microsurgery (ASRM) Meetings, the 96th Annual Meeting for the American Association of Plastic Surgeons (AAPS), and the Plastic Surgery Research Council (PSRC) 62nd Annual Meeting. Secondly, we compared bibliometric data, which were used as surrogates for academic productivity between male and female physicians invited to these meetings.

Methods

Study Sample

Our study sample consisted of all invited speakers at the following annual meetings in 2017: AAHS/ASPN/ASRM Meetings (January 10-17, 2017), AAPS (March 25-28, 2017), and the PSRC (May 4-7, 2017). The names of invited speakers were extracted from meeting programs found on each organization's website. Invited speakers to the AAHS/ASPN/ASRM Meetings were defined as "Chair," "Instructor," "Moderator," "Panelist," "Speaker," or "Course Faculty." For AAPS, titles for invited speakers included "Chairperson," "Program Chair," "Discussant," "Moderator," or "Speaker." Individuals included for analysis for the PSRC meeting were listed as "Chairperson," "Moderator," or "Panelist." Keynote speakers and individuals presenting podium and poster presentations were excluded from analysis. The meeting cohort is described in Table 1.

Subsequent analyses included only academic physicians, defined by having an M.D. (or equivalent medical degree) and an academic title (**Tables 2–3**) (e.g. Assistant Professor, Associate Professor, and Professor). Academic affiliation was determined by academic title; if a speaker did not possess an academic title, they were excluded from further analysis. This study was approved by the Human Research Protection Office at Washington University.

Invited Speaker Attributes

Characteristics of invited speakers were obtained from university websites and included gender, academic rank, current affiliation, and degree type(s) (i.e. M.D., Ph.D., etc). The abstracted list of invited speakers was then provided to two reference librarians (AS and CS) at Becker Medical Library of Washington University. Attributes of the invited speakers were confirmed using external sources such as Doximity, faculty pages, Google Scholar profiles, directories of organizations/universities, ORCID, LinkedIn, and NCBI My Bibliography pages.

Bibliometric Indices

We calculated h- and m-indices for all speakers. Proposed by Hirsch in 2005, the h-index is a quantitative metric based on analysis of publication data using publications and citations to provide an estimate of a scientist's work impact and quality.⁷ The h-index is calculated by ranking a researcher's publications, then calculating the highest number of h such that the author has h publications with at least h citations. Generally, an investigator with more highly cited articles will have a higher h-index than those with fewer highly cited articles or those with lower-impact publications.⁸ The m-value is a correction of the h-index for time, where y = number of years since the first publication ($m = h/y$). The m-value can be used as

an indicator for “scientific quality” corrected for age and thus can be used to compare scientists of different seniority.⁷

Publication Data

Elsevier Scopus (<https://www.scopus.com/>) was used to obtain all publication data. The following publication data were manually abstracted from Scopus: year of first publication, h-index, author order, and number of publications (career, all publication types). The publication types considered to be peer-reviewed were article, conference paper, review, and short survey. Analyses of Scopus publication data were performed in Microsoft Excel (Microsoft Office, Redmond, WA) to report m-value, number of peer-reviewed publications, and number of publications in 2015-2016. Script calculation for first and last author statuses were also performed. All data were extracted between October 2017-January 2018.

Statistical Analysis

Continuous variables were analyzed using t-tests for normally distributed data (**h-index, m-value, and year of first publication**) or Wilcoxon rank sum tests for non-parametric data (**number of publications**). Categorical data were compared using Chi-squared tests or Fisher’s exact tests. We built a multinomial logit regression, allowing us to use continuous or categorical demographic and bibliometric variables as independent variables to predict the probability of being an Assistant Professor, Associate Professor, or Professor. Detail about how our model was built is included as Supplemental materials (**See Text, Supplemental Digital Content 1**, which describes details of statistical model building to predict academic rank, [INSERT HYPERLINK HERE](#)). All statistical analyses were performed using R 3.4.3 with nnet package.^{9,10} Significance was set at $\alpha < 0.05$.

Results

Summary of Demographic Data

Demographics of all invited speakers are summarized in Table 1. Overall, there were 381 unique speakers that attended the five meetings in 2017. Women comprised 19.4% (74) of these speakers. Over one-third of invited speakers had the title of Professor (n=131, 34.4%), while over one-quarter (n=100, 26.2%) were Associate Professors. The proportion of physicians with additional degrees was 12.6%.

Gender Distribution of Invited Speakers

The distribution of invited speakers who were academic physicians was stratified by gender and academic rank (Table 2). In total, there were 282 unique academic physicians invited, forty-one (14.5%) of whom were women. By meeting, women accounted for 14.4% of the academic physicians speaking at AAHS/ASPN/ASRM, 11.5% at AAPS, and 17.5% at PSRC. Overall, there was a significant difference in the distribution of gender by academic rank ($p=0.0025$). The proportion of male speakers with Professor titles was significantly greater than the proportion of female speakers holding this rank. The proportion of male Assistant Professors (20.3%) was significantly lower than their female counterparts (36.6%).

Comparison of Bibliometric Data by Gender

Given the differences in distribution of academic rank between male and female invited speakers, we chose to report bibliometric data stratified by gender and academic rank (Table 3). Across all academic ranks, there were no differences in median year of first publication between genders. As expected, median year of first publication was earliest for Professors, then Associate Professors, and latest for Assistant Professors. H-index was not significantly different between male and female Assistant Professors ($p=0.064$) or Associate Professors ($p=0.714$). Among Professors in our cohort, however, men had significantly higher h-indices than women (26.6 vs. 16.0, $p=0.001$). Similarly, there were no differences in m-value between genders at the Assistant Professor ($p=0.346$) and Associate Professor ($p=0.419$) ranks, but m-value was significantly higher for male Professors compared to females (1.00 vs. 0.70, $p=0.037$). There were no statistical differences in the numbers of total career publications between men and women at the Assistant Professor ($p=0.067$) and Associate Professor ($p=0.479$) levels; however, men had significantly higher **median** numbers of total publications than women at the Professor level (**110 vs. 51.5**, $p=0.011$). Additionally, as a measure for recent academic productivity, we evaluated publication numbers for the preceding year, 2015-2016. There were no differences in recent academic productivity between genders at all academic levels—Assistant Professor ($p=0.253$), Associate Professor ($p=0.371$) and Professor ($p=0.255$). Additionally, we assessed authorship position—specifically first and last—in publications. For both metrics, there were no differences at the Assistant and Associate Professor ranks, but men had significantly higher **median** numbers of first (**18 vs. 6.5**, $p=0.005$) and last (**37 vs. 15.5**, $p=0.012$) author publications than women at the Professor level.

Multinomial Logit Regression Model Results

Results from our regression model are presented in Table 4. Our final regression model determined that the significant independent predictors of academic status are m-value, year of first publication, and gender. For each set of predictor values, the model returned three probabilities: the probability of being an Assistant Professor, Associate Professor, and Professor. Unlike standard linear models, multinomial logit models have coefficients that describe ratios of probabilities. Keeping all bibliometric variable values constant, the ratio of probabilities of being a Professor to Assistant Professor was 2.17 times greater for men than for women (OR=2.17, 95% CI: 1.61 to 2.92).

Discussion

Speaking invitations for scientific meetings are opportunities to increase individual visibility and signify an individual's contributions to their field and respect by their peers. Additionally, establishing a national and international reputation in a discipline is critical to academic promotion. Our results indicate that women had less representation as invited speakers at five major academic plastic surgery meetings in 2017 than their male counterparts. When only considering academic physicians, less than 15% of speakers were women. The dissemination of work, as measured by h-index and m-value, did not differ between men and women at the Assistant and Associate Professor levels; however, among Professors, males had greater h-indices and m-values and higher numbers of total, first, and

last author publications than their female counterparts. Additionally, in our regression, we found that even when m-value and date of first publication are equal for a man and a woman, the woman will have a significantly lower probability of being a Professor and/or a significantly higher probability of being an Assistant Professor. The gender differences observed in our study may be associated with attrition rates seen in academic surgery. Future studies are needed to address retention and attrition rates between genders in academic surgery.

Despite efforts to combat gender disparities, they persist in many academic disciplines including science, humanities, medicine, and even gender studies.^{1,2,11,12} Even when equal opportunities exist, women are not only less likely to be invited to speak at scientific meetings,^{1,3,4} but also receive fewer awards and grants,^{13,14} are cited less,^{15,16} and have research regarded as less valuable than that of men.^{17–19} These gender discrepancies have been described as two phenomena: (1) the “Matilda effect” and (2) the “leaky pipeline.” The “Matilda effect” is a term which describes the systemic under-recognition of female scientists as significant contributors in the STEM (science, technology, engineering, and mathematics) disciplines.^{17,20} The “leaky pipeline” describes the drop-off in the proportion of women compared to men at each step up in the academic ladder.^{21,22} Among invited speakers who were academic physicians, there was a notable difference in the distribution of academic ranks between men and women—consistent with this phenomenon. The proportion of female Assistant Professors was significantly larger than for males, whereas the proportion of male Professors was significantly larger than female Professors.

Additionally, we detected differences in bibliometric data between genders at the Professor level, where men have more total career publications, first and last author publications, and greater h-indices and m-values. These findings may have been biased by the low sample size of women who were Professors (n=8) compared to the sample of men who were Professors (n=115) in our cohort; however, it is also possible that our data represent academic productivity of males and females at that career stage, potentially detecting a gender gap in achievement in plastic surgery.

Although women have steadily accounted for half of all medical students since 2005²³ and also account for almost half of all current residents in the United States,²⁴ women continue to be underrepresented in leadership and at advanced promotion levels within academic medicine.²⁵ The gender gap may be explained by familial responsibilities and personal goals during earlier career stages, which may limit the amount of time dedicated to publications and other metrics of academic productivity directly related to promotion.^{8,26} Lack of female mentorship is another commonly cited explanation for the gender gap in academia.^{25,27,28} For example, one-third of women medical students entering plastic surgery reported a lack of female mentors as a barrier to mentorship.^{29,30} Previous studies have emphasized the positive impact of women in power to attract other powerful women and pave the way for female trainees.^{27,31} Recent literature suggests, however, that gender concordance of the mentor-mentee may be unnecessary.²⁸ Rather, male and female mentors alike should be cognizant of barriers faced by female mentees in order to effectively support and sponsor them.^{28,32}

In addition to mentorship, we argue that *sponsorship* is necessary to increase the representation of women as invited speakers to scientific meetings and as elected leaders in plastic surgery. We define sponsorship as the synergistic combination of mentorship and *endorsement* through connections and pitches by a more experienced and networked mentor. This idea was inspired by *The Tipping Point* by Malcom Gladwell. He argues that a select group of people are changemakers, responsible for the “tipping” of social epidemics, and describes three archetypes of people needed for social change: mavens, connectors, and salespeople. Mavens are individuals who have ideas and vast amounts of knowledge or information. Connectors are pivotal to the efficient spreading of ideas. Finally, salespeople are convincing individuals who have mastered the art of persuasion.³³

Sponsorship within academic medicine is significantly associated with success, but is more common among men than women.³² Proposed reasons for this sex disparity include mentors not identifying female mentees for sponsorship opportunities as often as male mentees, female mentees not requesting sponsorship, female mentees potentially having less powerful mentors leading to ineffective sponsors, and different mentorship needs for females compared to males.³² Regardless of the reason, we believe sponsorship from individuals acting as connectors and salespeople to endorse women is imperative to “tip” the scale towards gender balance in leadership positions within science and academic medicine.

Why is gender balance important? Gender parity and other types of diversity are not only critical from a social justice standpoint, but there is strong evidence that cognitive diversity yields better teams and improves organizational performance.^{34,35} As described by Scott Page, cognitive diversity is derived from all of our different life experiences—not just demographic, but also social, environmental, and familial--and diverse teams have a multiplicative diversity bonus over homogenous teams.³⁴ In complex systems like surgery, achieving gender balance fosters team diversity that may afford better care for patients and improved cost-efficiency.^{34,35} Inclusion of women in leadership is advantageous as studies have shown that companies with female CEOs are more admired, innovative, and profitable compared to those run by male CEOs.^{36,37}

More women are entering plastic surgery than ever before. According to ASPS statistics from March 2018, women account for 16% of all current ASPS members (888 out of 5,515). We found that women’s participation at these five national meetings is representative of the current active ASPS membership (14.5% in our study vs. 16% ASPS statistics). Encouragingly, women make up 37% of all residents in plastic surgery (476 out of 1,286). Perhaps with the increase of women entering our specialty, we will observe an increase in the proportion of women who are invited to speak at annual meetings and promoted to leadership positions over the coming years. We need to be more purposeful, however, not just selecting representation of our current membership demographics, but representing who we aspire to be in the future.

Optimistically speaking, our analysis did find that there were more female than male Assistant Professors as invited speakers, which could reflect more active inclusion of women at our meetings and/or more early opportunities for women in plastic surgery. As innovators, plastic surgeons remain at the forefront of medicine. We are leaders, creators, and problem

solvers. We have the unique opportunity to lead other surgical and medical specialties in the movement to achieve gender balance not only at our annual scientific meetings, but also at all leadership positions and roles.

There are discernible limitations in our study. First, several weaknesses relate to data collection itself. For example, some speakers had organizational or university profile pages that were not in English; others had limited information. Data extraction took place between October 18, 2017 to January 9, 2018. Since this time, university affiliations, academic ranks, and publication data may have changed. Moreover, some speakers published under maiden and married names, which we attempted to capture, although it is possible that our publication data are incomplete. Scopus is currently updating citations from 1970 to 1996, so the h-indices for individuals who published during this time may not be accurately depicted, although men and women would be equally impacted. Additionally, a recent study found inconsistencies in h-index, particularly among plastic surgeons, calling for a more reliable metric of productivity.³⁸ Second, our results are limited to only five meetings in 2017 and may not be generalizable to the representation of all plastic surgery meetings across all years. The representation of invited speakers may vary across craniofacial, aesthetics, and other specialties within plastic surgery, which we did not investigate. Third, our analyses included all academic physicians who were invited to speak at these meetings and not just plastic surgeons. For AAHS and ASPN, our data included physicians in orthopedics and neurosurgery. Fourth, publication data are not the only metrics used to invite speakers to plastic surgery meetings. Most plastic surgeons are, in-fact, non-academic and contribute in many other impactful ways. Future studies are needed to evaluate a broader scope of meetings and conferences that go beyond academic plastic surgery as many courses and meetings, particularly in aesthetic surgery, feature non-academic surgeons. Fifth, we did not investigate how invited speakers are selected at each meeting. Finally, our findings apply to the individuals who accepted the invitation to speak; we did not capture those who declined the invitation. Underrepresentation of female invited speakers may be self-selected as women are more likely than men to decline invitations to present.^{1,2} Previous studies have proposed reasons driving the gender difference in self-selection at conference presentations. Women may be less aware or have inadequate mentorship regarding the value in presenting at conferences.¹ Women may also be more risk averse and reluctant to promote their research than men.¹⁵ Additionally, familial responsibilities may be more burdensome for women than for men, leading to lower meeting attendance. Perhaps childcare support at meetings could encourage greater participation among women in academic medicine. Additional studies are needed to determine if gender differences in self-selection at academic plastic surgery meetings exist and why this may be the case.

Conclusions

Women are in the minority as invited participants at academic plastic surgery meetings, even though the dissemination of published work of women was no different than that of men among junior and mid-career faculty. In addition to mentorship, we encourage the adoption of sponsorship, or the endorsement by more experienced or well-known individuals in the field, to achieve gender balance at scientific meetings and leadership positions in our specialty. While current data reflect demographics of ASPS membership, we suggest

purposeful inclusion of more diverse representation for qualified meeting speakers in order to reflect the evolving face of plastic surgery.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Demographics of all invited speakers at academic plastic surgery meetings.

	All meetings (unique individuals)	AAHS/ASPN/ASRM 2017	AAPS 2017	PSRC 2017
Total, n	381	276	100	45
Women, n (%)	74 (19.4%)	56 (20.3%)	14 (14.0%)	8 (17.8%)
Academic Title				
Assistant Professor, n (%)	68 (17.8%)	52 (18.8%)	10 (10.0%)	9 (20%)
Associate Professor, n (%)	100 (26.2%)	70 (25.4%)	24 (24.0%)	24 (53.3%)
Professor, n (%)	131 (34.4%)	88 (31.9%)	53 (53.0%)	9 (20%)
Non-MD, n (%)	41 (10.8%)	37 (13.4%)	0	4 (8.9%)
MD with advanced degree, n (%)	48 (12.6%)	37 (13.4%)	11 (11.0%)	7 (15.6%)
Year of first publication				
Median	1997	1997	1992	1999
Range	1964-2016	1968-2016	1964-2008	1977-2014

Table 2.

Distribution of academic physicians invited to speak at academic plastic surgery meetings stratified by academic rank.

	Women	Men	p-value
All meetings (n=282)	41 (14.5%)	241 (85.5%)	0.0025
Assistant Professor (n=64)	15 (36.6%)	49 (20.3%)	
Associate Professor (n=95)	18 (43.9%)	77 (32%)	
Professor (n=123)	8 (19.5%)	115 (48%)	
AAHS/ASPN/ASRM 2017 (n=195)	28 (14.4%)	167 (85.6%)	<0.001
Assistant Professor (n=49)	13 (46.4%)	36 (21.6%)	
Associate Professor (n=66)	13 (46.4%)	53 (31.7%)	
Professor (n=80)	2 (7.2%)	78 (46.7%)	
AAPS 2017 (n=87)	10 (11.5%)	77 (88.5%)	0.670
Assistant Professor (n=10)	1 (10.0%)	9 (11.7%)	
Associate Professor (n=24)	4 (40.0%)	20 (26.0%)	
Professor (n=53)	5 (50.0%)	48 (62.3%)	
PSRC 2017 (n=40)	7 (17.5%)	33 (82.5%)	0.863
Assistant Professor (n=8)	1 (14.3%)	7 (21.2%)	
Associate Professor (n=23)	5 (71.4%)	18 (54.5%)	
Professor (n=9)	1 (14.3%)	8 (24.2%)	

Table 3.

Bibliometric data of academic physicians invited to speak at academic plastic surgery meetings by academic rank. **For non-parametric data, Q1 = 25th percentile, Q3 = 75th percentile.**

	Women (n=41)	Men (n= 241)	p-value
Year of first publication, mean			
Assistant Professor (n=64)	2003	2001	0.369
Associate Professor (n=95)	2000	1998	0.269
Professor (n=123)	1992	1989	0.466
h-index, mean $\pm$ SD			
Assistant Professor	7.5 $\pm$ 4.0	10.1 $\pm$ 5.8	0.064
Associate Professor	15.4 $\pm$ 5.1	14.9 $\pm$ 6.4	0.714
Professor	16.0 $\pm$ 6.1	26.6 $\pm$ 12.9	0.001
m-value, mean $\pm$ SD			
Assistant Professor	0.61 $\pm$ 0.36	0.72 $\pm$ 0.40	0.346
Associate Professor	0.95 $\pm$ 0.36	0.87 $\pm$ 0.41	0.419
Professor	0.70 $\pm$ 0.32	1.00 $\pm$ 0.04	0.037
Number of total career publications, median [Q1, Q3]			
Assistant Professor	24 [13.5, 29.5]	34 [18, 45]	0.067
Associate Professor	51 [33.8, 62.3]	53 [31, 79]	0.479
Professor	51.5 [39.5, 87.3]	110 [61, 186]	0.011
Number of total career peer-reviewed publications, median [Q1, Q3]			
Assistant Professor	18 [11, 25]	28 [16, 39]	0.048
Associate Professor	43.5 [30, 53.5]	46 [26, 68]	0.453
Professor	42.5 [34.3, 73.5]	90 [53, 147]	0.009
Number of publications 2015-2016, median [Q1, Q3]			
Assistant Professor	6 [2, 8]	8 [3, 11]	0.253
Associate Professor	9 [4.5, 13.8]	9 [5, 19]	0.371
Professor	7.5 [5.5, 15.3]	13 [6.5, 22.5]	0.255
Number of career first author publications, median [Q1, Q3]			
Assistant Professor	6 [5.5, 10]	7 [2, 13]	0.812
Associate Professor	11.5 [7.3, 16.3]	11 [6, 17]	0.497
Professor	6.5 [2.8, 12.3]	18 [11, 29]	0.005
Number of career last author publications, median [Q1, Q3]			
Assistant Professor	1 [0, 6]	4 [1, 12]	0.071
Associate Professor	8.5 [3.5, 13]	13 [6, 29]	0.055
Professor	15.5 [8.8, 26.3]	37 [18.5, 69.5]	0.012

Table 4.

Regression of academic rank.

	Multiplier of ratio of probability of <i>Associate:</i> <i>Assistant Professor</i>	95% CI		Multiplier of ratio of probability of <i>Professor:</i> <i>Assistant Professor</i>	95% CI
Sex					
Female	-reference-			-reference-	
Male	1.16	0.65 to 2.09		2.17	1.61 to 2.92
m-value increase by 1.0	4.65	3.15 to 6.86		18.63	13.29 to 26.12
Year of first publication increase by 1 year	0.9472	0.947 to 0.948		0.7721	0.7719 to 0.7724