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Title

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Journal

Dermatology Online Journal, 22(4)

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Publication Date

2016

DOI

10.5070/D3224030651

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Peer reviewed

Original

A gender-based comparison of promotion and research productivity in academic dermatology

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Dermatology Online Journal 22 (4): 2

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Abstract

Purpose: Gender disparities within academic promotion have been reported in several medical specialties. Female representation in association with research productivity has not been reported among academic dermatologists. As research productivity is a heavily weighted factor in determining promotion, we sought to determine whether gender disparities in academic rank and scholarly impact, measured by the *h-index*, exist in academic dermatology.

Methods: In 2015, the authors determined gender and academic rank using academic dermatology department websites. *H-index* and publication range were determined using the Scopus database. Rank, *h-index*, and publication range were compared between male and female academic dermatologists.

Results: The *h-index* of academic dermatologists increased with successive academic rank from Assistant Professor through Professor ($p < 0.001$), although no significant difference existed between Chairs and Professors. Publication range also increased with each successive rank from Assistant Professor through Professor ($p < 0.001$), with no statistical significant difference between publication range of Chairs and Professors. Overall, men had higher *h-indices* than female colleagues ($p < 0.001$). This difference was maintained when controlling for academic rank among Assistant Professors, Professors, and Chairs and when controlling for publication range in years.

Conclusion: Women in academic dermatology are underrepresented among senior academic ranks. The difference in scholarly productivity between male and female academic dermatologists may contribute to this disparity. Recommendation for early involvement in research activities may help minimize this gap.

Keywords: *h-index*; gender disparities; academic promotion; dermatology; productivity

Introduction

Women represent half of all United States medical school graduates, compared to 31% in 1982 [1, 2, 3]. This is a trend consistent with the movement towards gender equality. However, the disparity between the number of men and women holding senior

faculty positions has been well documented in several fields of medicine, as well as in business and industry [1, 4, 5, 6, 7, 8, 9, 10, 11, 12]. Women comprise only 32% of academic faculty positions and women with faculty positions take longer to get promoted to senior academic ranks than their male counterparts [11, 13, 14, 15]. A study of academic dermatology in 2012 determined that although women accounted for 47% of academic dermatologists, they held only 27% of senior positions [6, 13].

There are several reasons for gender disparity in academic medicine. Female physicians have noted that available call coverage, flexible work hours, the presence of other female colleagues, and ability to balance a family life with work are factors that influence decisions to choose medical specialties and work environments [2, 16, 17, 18, 19]. In particular, the desire for childbearing early in a women's career constrains early-career productivity [20, 21, 22]. A study from the Mayo Clinic determined that although women had lower early-career publication rates than male counterparts, these equalized with or even surpassed male publication rates later in their careers [10].

Promotion within academic medicine usually weighs scholarly productivity more heavily than clinical performance and contribution to medical education [10, 23]. Thus, whereas women have equivalent or even higher clinical performance than their male counterparts [24], research contribution is cited as the most highly weighed factor when determining promotion and hiring [25, 26, 27]. Usually, the number of publications or the number of citations of an author's work is used as an objective measure of research productivity. However, these values taken alone have limitations to their utility. For instance, number of publications does not take into consideration the significance of the research and number of citations can be skewed if just one publication was heavily cited.

To account for these limitations, Dr. J.E. Hirsch introduced the '*h-index*' in 2005 as an objective, bibliometric parameter that takes into account both the quantity and academic impact of an individual's research contributions [28]. The *h-index* is the number of 'h' articles cited 'h' times in peer-reviewed journals. **For example, if an academic dermatologist has ten publications, each cited 10 times, his or her *h-index* is 10. If an individual has 50 publications, 3 cited 15 times, 1 cited 12 times, 6 cited 10 times and the rest cited fewer times, his or her *h-index* is still 10 as this person has ten total papers cited at least ten times.** As such, the *h-index* is not only based on the number of publications but also on the significance of these works and the consistency of citations. *H-indices* for academic physicians are available on Scopus and ISI Web of Knowledge, with a high degree of correlation between the results of these sources [29]. The use of the *h-index* to gauge research productivity and promotion has been studied in several medical subspecialties [7, 29, 30, 31, 32, 33].

There has been no analysis of the value of the *h-index* in determining academic rank and promotion in dermatology. Moreover, there has been no study of the impact of gender on academic promotion and scholarly productivity within academic dermatology. The objectives of this study are to determine the relationship between scholarly productivity, as measured by the *h-index*, and academic rank in dermatology and to determine gender disparities in academic productivity and promotion.

Methods

Dermatology departmental listings were obtained from the Fellowship and Residency Interactive Database (FREIDA) from the American Medical Association. Individual websites of each of the 119 academic departments were visited to accrue data, including a list of faculty members with gender and academic rank for each physician. Gender was determined independently using names and photographs from online websites. Each faculty member was classified into an academic rank (assistant professor, associate professor, professor, and chair). **Although Chairs are professors, they were not included in the professor category to avoid double counting these individuals.** Exclusions included non-physicians, non-academic physicians, and part-time or volunteer faculty members and faculty physicians whose rank could not be determined.

Of the 119 programs from the FREIDA database, 16 lacked online faculty listings or clear delineation of academic rank and 8 programs only designated departmental chairperson and did not note academic ranks for other faculty. Thus, after using the exclusion criteria, 103 departments were included for an analysis of 1061 academic dermatologists.

The Scopus database was used to record each academic physician's *h-index*. This database includes over 40 million publication records from 18,500 peer-reviewed journals [34]. Publication range, defined as the years of publication activity, was also recorded from the Scopus database. Each individual's name and department affiliation were used to ensure the correct faculty member's *h-index* and publication range were recorded. In addition, the subject matter of the individual's publications was used to ensure accuracy. For instance, if a member had no publications related to dermatology, this was most likely the incorrect individual.

Statistical analyses were conducted with Kruskal-Wallis tests, which were used for comparison of continuous variables and Pearson chi-square tests, which were used for comparison of categorical variables. Statistical significance was set at $p < 0.05$.

Analysis was performed using Statistical Analysis Software (SAS Institute, North Carolina, United States). This study qualifies as a nonhuman subject research per the Institutional Review Board.

Results

The breakdown of academic rank consisted of 466 (43.9%) assistant professors, 233 (22.0%) associate professors, 268 (25.3%) professors, and 94 (8.8%) chairs. The *h-index* of academic dermatologists increased with successive academic rank from assistant professor (5.21 ± 4.8) through professor (22.5 ± 15.4) ($p<0.001$) (Figure 1). No statistical significant difference was noted between *h-indices* of chairs (23.6 ± 16.8) and professors ($p=0.25$). The publication range also increased with each successive rank from assistant professor (11.24 ± 8.8 years) through professor (28.04 ± 11.4 years) ($p<0.001$), although there was no statistical significant difference between publication range of chairs (28.67 ± 11.9 years) and professors ($p=0.32$).

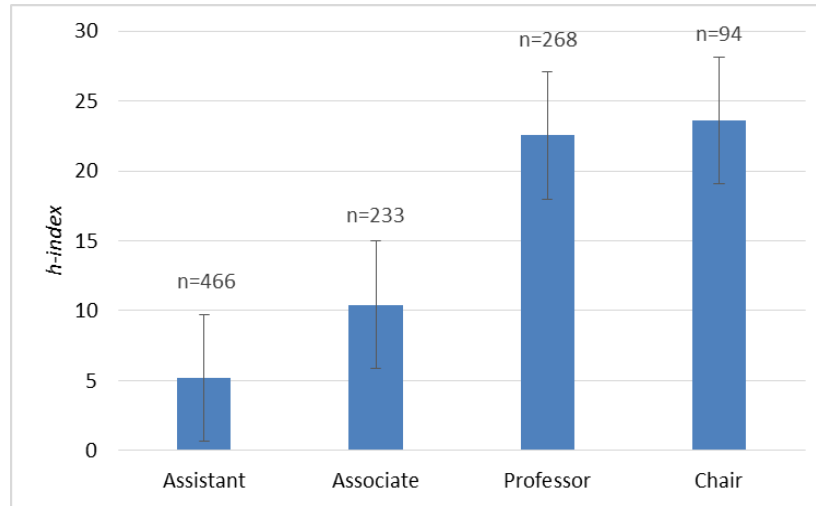


Figure 1. Mean *h-index* of academic dermatologists from 103 institutions, organized by academic rank. Error bars represent standard error of measurement.

Women constituted 474 (44.7%) of academic dermatologists in our cohort. They comprised 267 (57.3%) of assistant professors, 98 (42.1%) of associate professors, 86 (32.1%) of professors, and 23 (24.5%) of chairs (Figure 2). When considered by gender, academic rank representation differed with a larger proportion of men serving at senior ranks ($p<0.001$). Overall, men had higher *h-indices* than female colleagues (15.3 ± 14.7 vs 8.7 ± 9.3) ($p<0.001$). When controlling for academic rank, a statistically significant difference in *h-indices* between men and women was noted among assistant professors, professors, and chairs ($p<0.001$, $p=0.001$, and $p=0.001$, respectively) (Figure 3). A statistically significant difference in *h-indices* was also noted when controlling for publication range in years. Men had a higher *h-index* in the cohort with 1-20 years of publication experience ($p<0.001$) as well as from 21-40 years of publication ($p<0.01$) (Figure 4). When controlling for fellowship, men had significantly higher *h-indices* than women for Procedural Dermatology/Mohs micrographic surgery fellowship (10.6 versus 7.6, $p=0.04$), Dermatopathology (16.34 versus 9.73, $p<0.01$), and Pediatric Dermatology (19.75 versus 8.94, $p<0.01$) (Figure 5).

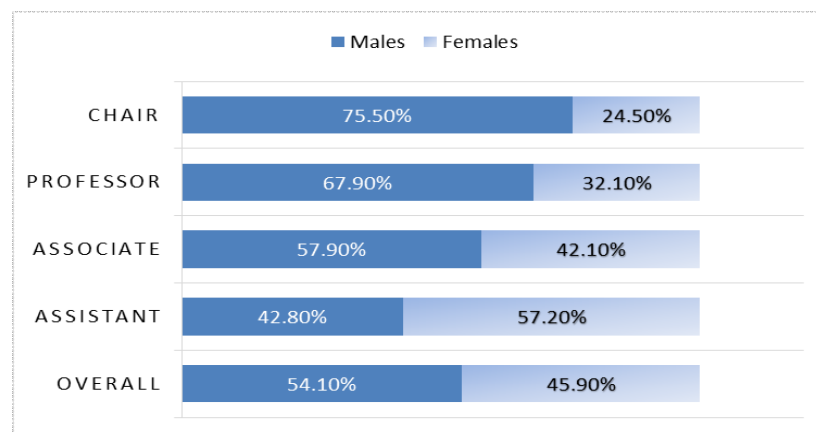


Figure 2. Gender distribution of 1061 academic dermatologists from 103 institutions included in this analysis.

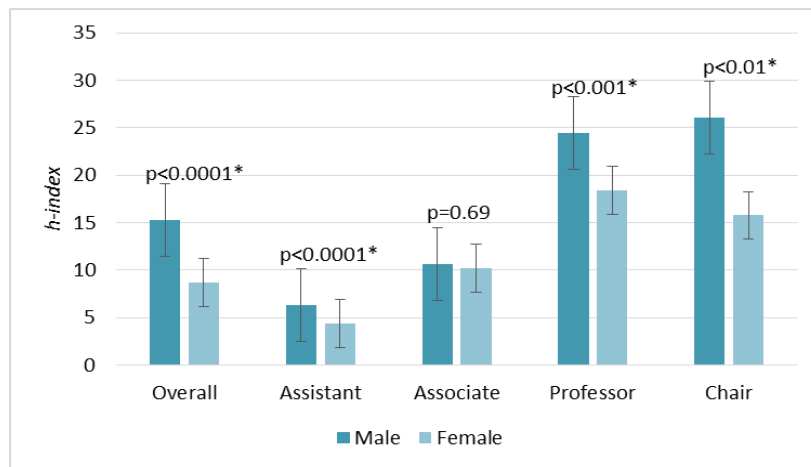


Figure 3. Mean *h-index* of academic dermatologists from 103 institutions categorized by both gender and academic rank. Error bars represent standard error of measurement. We denoted statistically significant differences with a (*).

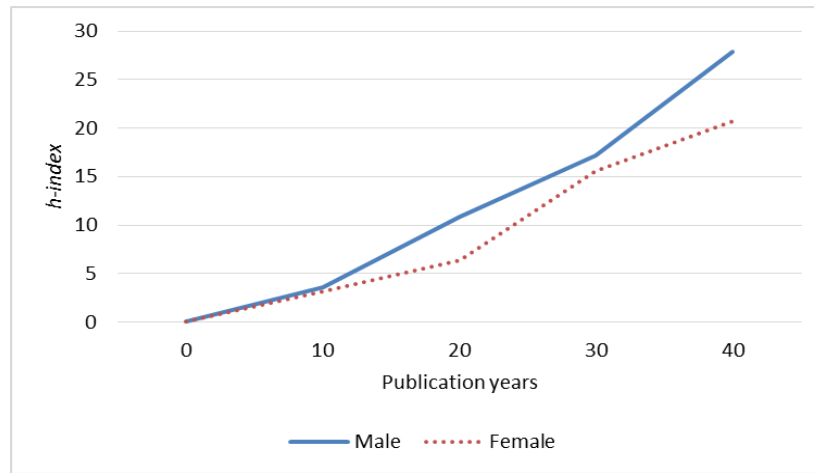


Figure 4. Chart of *h-index* and publication range of academic dermatologists. Slope of these lines represents the rate of research productivity.

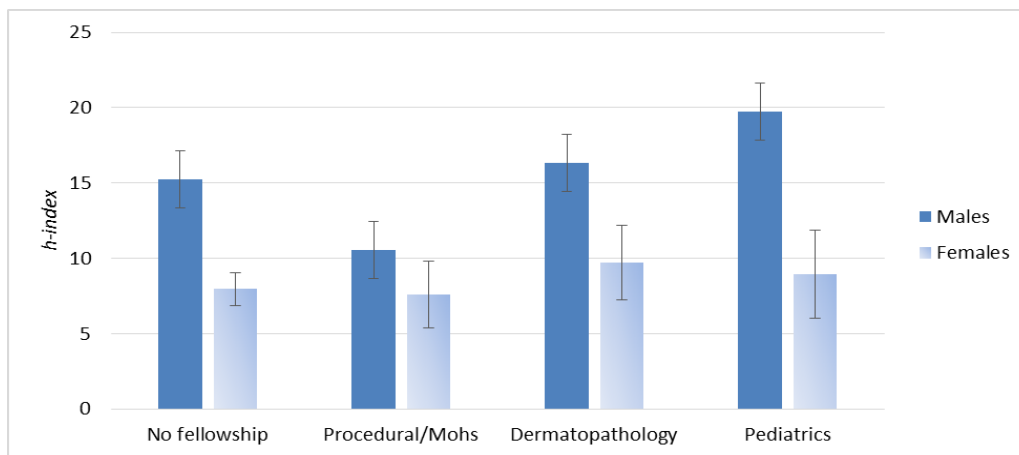


Figure 5. Mean *h-index* of academic dermatologists categorized by both gender and fellowship. Error bars represent standard error of measurement. We denoted statistically significant differences with a (*).

Conclusions

Gender inequality in the workplace in the United States is reported in many fields, including medicine. In 2014, the Institute for Women’s Policy Research determined that women consistently earn less money than men in every occupation for which there is measureable data [35, 36]. In addition, although women have made remarkable strides in performing occupations that were previously done exclusively by men, they are underrepresented in senior ranks in many fields [36, 37, 38]. Our analysis concluded a similar finding. The percentage of women enrolling in medical school is equal to the percentage of men [3, 7]. However, there is

a disparity in the number of women achieving academic promotion and occupying senior leadership roles in diverse fields, including anesthesiology, neurosurgery, otolaryngology, ophthalmology, radiation oncology, plastic surgery, pediatrics, and, as our investigation shows, dermatology [5, 6, 7, 8, 9, 11, 12, 31]. In fact, the representation of women as full professors only increased from 7% in 1978 to 10.5% in 1998, despite the greater increase in number of women entering medicine [36]. In addition, less than one-fifth of journal editorial board members consist of women [39].

The primary goals of this study were to demonstrate a correlation between research productivity, as measured by the h-index, gender, and academic rank, and to elucidate the underrepresentation of women in senior faculty roles in academic dermatology. In corroboration with previous studies, our findings demonstrated strong associations between higher h-index and higher academic rank [29, 30, 31, 32, 33]. This confirms the significance of scholarly productivity on promotion, as Professor and Chairs had the highest h-indices in our cohort of 1,061 academic dermatologists from 103 institutions (Figure 1). In addition, publication years increased with increasing rank, demonstrating the importance of longevity of careers to allow for academic promotion. This has also been demonstrated in other studies [7, 30].

In our cohort, women constituted less than half of the total number of academic dermatologists. What is more surprising, however, is that women comprised more than half of assistant professors, the lowest academic rank, but roughly one-third of professors and roughly one-quarter of chairs. Thus, despite the increased number of women entering competitive medical fields, there is a gender gap in dermatology among women in leadership roles (Figure 2). In addition, when controlling for rank, a significant difference in scholarly productivity existed for all ranks except associate professor (Figure 3). The ranges for standard error of measurement between male and female overlapped or abutted for all but the rank of chair. This indicates that there is a gender disparity in research productivity, especially for women in senior faculty roles. In addition, when controlling for fellowship, men had significantly higher measures of scholarly productivity than women (Figure 5).

Several other studies have demonstrated that women tend to have equal or even higher measures of scholarly productivity later in their careers [5, 7, 10]. When looking at the slopes of Figure 4, it is evident that male and female academic dermatologists have a relatively equal rate of increase early in their careers. Between 10 and 20 years, men outperform women. However, between 20 and 30 years, women outperform men, as suggested by the steeper slope. This is likely because women may either take a family leave of absence or to temporarily move to part time status in the middle of their careers.

Underrepresentation of women in senior academic ranks is likely related to a conglomeration of factors. These include the lack of females in leadership positions that can serve as role models for young female trainees. Studies have demonstrated that keen mentorship is a principal determinant of career development [25, 40, 41, 42]. Whereas there have been attempts to foster mentoring programs for female medical students through American Medical Women's Association and other organizations, these have not shown significant changes in the gender disparity of academic medicine [40]. As more women are entering academic medicine, perhaps there will also be an increase in female mentorship. Our study demonstrates another factor that may influence the underrepresentation of women in senior faculty roles—scholarly productivity. It is well documented that research productivity is essential and the most weighed factor when determining hiring and promotions [26, 27]. In addition, other studies have demonstrated that female physicians tend to participate in educational and administrative roles, leaving less time for research productivity [43, 44]. The use of "Educators Portfolio", or a measure of time spent teaching residents and students, is becoming a more popular supplement to a research portfolio [45, 46]. Another reason for the underrepresentation of women involves the relatively recent surge of women entering academic medicine. As such, time will be the primary factor to minimize the gender disparity. Perhaps most importantly, women are more likely than men to take time off to start families and raise children, therefore limiting early-career academic productivity.

Although the h-index proves to be a useful tool to measure academic productivity, it has its limitations. First, deliberate self-citation to achieve greater h-indices may inflate this measure. However, it is difficult to influence h-index significantly with high values [47]. In addition, the h-index does not take into account the order of authors on a work, and therefore, a fourth or fifth author garners the same number of citations as the lead author on a publication. The h-index also does not take into account longevity of careers, which can influence the value of the h-index [48, 49, 50]. We recommend utilization of the h-index to determine academic productivity, while acknowledging that newer practitioners will have lower h-indices because of a lower number of active years of publication.

Participation in quality research should be emphasized early in training to prepare residents for fruitful scholarly careers in academic dermatology. In addition, other factors, including educational and administrative duties, should be taken into account when considering promotions. Finally, as women increase in number in academic dermatology, it will be interesting to examine the impact of increased female mentors over time on the gender disparity in senior faculty roles.

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