

Gender Comparison of Scholarly Production in the Musculoskeletal Tumor Society Using the Hirsch Index

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OBJECTIVE: Despite an increase in the proportion of female medical school graduates, the number of women in orthopedic surgery remains low. To examine the presence of gender disparities in scholarly production, the authors used the Hirsch index (*h-index*) to assess members of the Musculoskeletal Tumor Society (MSTS), a well-defined subspecialty of orthopedic surgery.

DESIGN: Using the MSTS Membership Directory, the authors assessed those practicing at an academic institution in the United States. Members' sex and rank was obtained from their department's website, and their *h-index* and years since initial publication was collected from the Scopus database.

SETTING: Research was performed at New Jersey Medical School, an institution, using online databases.

PARTICIPANTS: A total of 247 members of the MSTS were eligible, of whom 125 practiced at a US academic medical center and were included in the study.

RESULTS: The MSTS is composed of 247 members, 28 (11%) of whom are women. Within US academic medical centers, there are 125 members, including 17 (14%) women. Mean *h-indices* increased with rising academic rank from 5.42 for assistant professors to 19.28 for professors. Publication ranges showed an increase from 11.03 years for assistant professors to 29.52 years for professors. The *h-index* and publication years of chairpersons were nearly equal to those of professors.

Using the *h-index*, it was found that men outproduce women—13.4:7.9. Men outnumber women at every rank, increasingly so at higher ranks. The authors found that there was a significant difference in productivity between ranks ($p < 0.01$) and between sexes ($p = 0.035$), but not between sexes at the assistant professor, associate professor,

or professor levels ($p = 0.147$, 0.581 , and 0.263 , respectively).

CONCLUSIONS: The *h-index* shows differing production among the sexes and ranks in the MSTS. No significant difference exists between the sexes when members are organized by academic title. (J Surg Ed 72:1172-1178. © 2015 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: *h-index*, gender comparisons, statistics and numerical data, bibliometrics, gender bias, women physicians

COMPETENCIES: Professionalism

INTRODUCTION

The proportion of women pursuing careers in medicine has dramatically increased from approximately one-third of all applicants and US medical students to approximately 50% of graduating medical students over the last 30 years.¹ Despite the near equality of entering and graduating medical students, women have disproportionately entered nonsurgical fields upon graduation²; are underrepresented in academic leadership positions,²⁻⁵ including those within surgical specialties²; and are first or senior author on publications less often, though that trend more or less mirrors the number of professors.⁶ In 2012, women represented 14% of applicants to orthopedic residency⁷ and 12% of all orthopedic surgeons. Although the percentage of women entering orthopedic residency programs has grown, it has done so at a slower rate than in other surgical fields⁸ and is the lowest among all residencies.¹ Among orthopedic surgeons, women constitute a decreasing percentage of academic faculty as the rank increases; just 5% of full professors are women.⁵

To understand such disparities, it is important to recognize the factors that are considered when evaluating

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candidates for promotion. In a small survey, surgeon faculty members spent time on administrative duties, research activities, teaching, counseling students and residents, and writing grants in addition to their clinical duties.⁹ These factors are all taken into account as researchers and clinicians are evaluated for promotion in their tenure and nontenure tracks.¹⁰ Research is an important and easily measurable way to compare academic physicians, as it is quantifiable by a number of methods. To begin delving into the possible gender disparities that may exist in orthopedics, we assessed the importance of research in a society for a well-defined orthopedic subspecialty.

The Hirsch index (*h-index*) was suggested by Dr. Hirsch, a physicist, as a simple and useful way to characterize the scientific output of a researcher. It represents the number of publications, *n*, with at least *n* citations.¹¹ It has been shown to correlate well with academic standing in a variety of medical fields.¹²⁻¹⁷ Various other iterations of the *h-index* have also been developed for applying it to groups of researchers and correct for some of its flaws¹⁸⁻²² and to show correlation with other recognized publication metrics.^{13,23-27} Eloy et al.²⁸ found that there were differences in *h-indices* between the sexes among otolaryngologists of the same academic rank. Because the Musculoskeletal Tumor Society (MSTS) places an emphasis on research and is in a field with great gender imbalance, the *h-index* can be a valuable tool to compare members of different academic ranks and sexes.

We examined the MSTS to assess if there was parity in research productivity between its male and female members using the *h-index*. If no difference was determined, we examined whether there is parity once rank and experience, defined here as length of time since first publication, were considered. Finally, we aimed to explain any differences that remained using previous literature.

MATERIAL AND METHODS

This is a cross-sectional study using members of the MSTS. The 2012 MSTS Membership Directory was used to compile a list of members. It is composed of 247 members, 28 of whom are women (11%). We eliminated 28 physicians because they practiced outside the United States, and 94 physicians were eliminated because they did not have an academic title. The 125 remaining members, including 17 women (14%), were categorized by academic rank. Orthopedic department listings were obtained from the American Medical Association's Fellowship and Residency Interactive Database (FREIDA). Online department listings were used to gather information about faculty members, including academic ranks. For those who were not listed, a supplementary online search was done to learn their affiliations, if any existed.

The physicians were organized into categories of assistant professor, associate professor, professor, and chairperson.

Those who were chairpersons were also counted in the appropriate professor ranking. Clinical, adjunct, and voluntary faculty were excluded. Each faculty member's sex was determined by the authors using names, faculty listings, and biographical descriptions when appropriate.

Each faculty member's *h-index* and years of publication range were obtained from the Scopus Database (www.scopus.com). The surname and initials or the first name was inputted to search for publications authored by a specific laureate. The Scopus Author Identifier uses an algorithm that matches author names based on their affiliation, address, subject area and source title, dates of publication, citations, and coauthors. These were used to focus the search and compile a list of all publications for each laureate. The bibliometrics was extracted by selecting the proper author or by viewing the citation overview of this list if that was not possible. If the individual had a common last name and multiple results appeared, departmental affiliations, previous positions with other departments, and the presence (or absence) of orthopedic or orthopedic-related journals were used to ensure that the *h-index* and publication range obtained for each author were related to the appropriate individual. All data were obtained in September 2013.

Calculations were performed using Microsoft Excel (Redmond, WA). Mean values were calculated and error was determined using the Kruskal-Wallis test or Mann-Whitney *U* test, depending on which was appropriate. Threshold for significance was set at $p < 0.005$.

RESULTS

The *h-indices* by sex indicate that men (13.5) are more productive than women (7.4) are when assessed by *h-index* ($p < 0.001$; Fig. 1).

Mean *h-indices* increased with rising academic rank from 5.42 for assistant professors to 19.36 for professors ($p < 0.001$, Fig. 2). The *h-index* of chairpersons was nearly equal to that of professors. The number of years since first publication also rose as the ranks progressed from assistant professor (11.03) to professor (29.61) ($p < 0.001$, Fig. 3). Further broken down by rank (Fig. 4), men outperform women at the professor level (20 vs 11.75, $p = 0.03$), but at the other ranks, the results were mixed and did not reach statistical significance: women = 11.5 vs men = 10.6 ($p = 0.56$) at the associate professor level and men = 6 vs women = 3.25 ($p = 0.14$) at the level of assistant professor. Men had more experience (Fig. 5) at the assistant professor level (12.2 vs 6.75, $p = 0.04$) and professor level (31.0 vs 13.5, $p < 0.001$), but not at the associate professor level (17.1 vs 17.25, $p = 0.851$). A scatter plot (Fig. 6) comparing *h-indices* and publication years for men and women shows a general correlation between increased *h-index* with increased years of publication. The most

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