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Trends in Authorship of Articles in Major Ophthalmology Journals by Gender, 2002–2014

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Purpose: To evaluate trends in the prevalence of women authors in ophthalmology in recent years.

Design: Cohort study.

Participants: Authors listed in publications of 6 leading ophthalmology journals between January 2002 and December 2014.

Methods: Using the PubMed search engine, we conducted an observational study of trends in gender distribution of all authors in 6 leading ophthalmology journals between January 2002 and December 2014. In multiauthored articles, the first listed author often is the lead investigator and the last author is the senior author. Therefore, the full names and positions (first, middle, or last) of all authors in every article were collected. A Google-based name identifier was used to assign the gender of authors.

Main Outcome Measures: Proportion of women authors throughout the study period in all journals, general ophthalmology versus subspecialty journals, and basic science versus clinical research journals. Furthermore, we assessed the proportion of women in different authorship positions (first, middle, and last).

Results: A total of 102 254 authors from 23 026 published articles were analyzed. There was a significant rise over time in the percentage of women authors, with a steeper slope for first authors than for last authors ($P<0.001$), although in 2014, women authors were less than the 50% mark in all categories of authorship. The rise in the percentage of women authors was similar in basic and clinical research, but was steeper for first authorship than for last authorship ($P<0.001$). In all 3 authorship positions (first, middle, or last), women's contributions consistently were higher in basic research publications. The rise in the percentage of women authors was significantly steeper for general journals than for subspecialty journals ($P<0.001$). There was no significant rise for last authorship in subspecialty journals. In all 3 authorship positions, the proportion of women was consistently higher in general ophthalmology journals than for subspecialty journals.

Conclusions: Despite an overall increase in the contribution of women to the field of ophthalmology, contributions to articles published in subspecialty ophthalmology journals and the proportion of women listed as last authors on overall articles published in ophthalmology journals are still low. *Ophthalmology 2016;■:1–6 © 2016 by the American Academy of Ophthalmology.*

Despite the reduction in the disparities between men and women in the workforce that started with the important role that women played in the United States during the First and the Second World Wars,[1,2] presently there are still discernible differences between the genders in the fields of science and medicine. For instance, salaries differ significantly between men and women. In 2008, among newly trained physicians in New York State, men were paid on average 17% more than women, compared with a 12.5% difference in 1999.[3] The significant gender gap could not be explained by specialty choice, practice setting, work hours, or other characteristics.[3]

The professional careers of physicians and scientists are still influenced by gender stereotypes and their accompanying expectations,[4,5] and women remain underrepresented in leadership positions in academic medicine worldwide.[4,5] According to the Association of American Medical Colleges, women accounted for 32% of associate professors, 20% of full professors, 14% of department chairs, and 11% of deans at United States medical schools in 2012[6]—far from the near gender parity observed among medical students since 1995.

Scholarship is the primary consideration in decisions regarding promotion and tenure in academic medicine and is a major contributor to professional reputation.[7] Often, the first author of an article is considered to be the lead investigator and the last author is considered to be the senior investigator. Although gender disparities were found to decrease in the academic world, in terms of grant funding,[8] academic hiring,[9] and acceptance of research at scholarly journals over the past 2 decades,[7] it has been noted that, in certain fields, men predominate in the more prestigious first and last author positions of scientific publications.[7] To the best of our knowledge, no

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corresponding data were reported specifically for the medical field.

We therefore conducted this study to test the hypotheses that (1) in ophthalmology, women are underrepresented in the first and last authorship positions of academic publications, similar to trends well described for nonmedical scientific fields; and (2) in recent years, this apparent disparity has decreased. We studied whether these trends, if any, are similar in ophthalmology articles related to basic research and those with a clinical orientation. In addition, we examined whether there were differences in trends according to the orientation of the journal (general ophthalmology or subspecialty).

Methods

Because this study did not involve the examination or treatment of patients or a review of patient records, it was exempt from review and approval by our research ethics committees.

Journal Selection

Two of the authors (M.M. and N.G.) used the PubMed search engine to analyze all articles published in 6 preselected ophthalmology journals chosen for their impact factor (IF) as listed by the Journal Citation Reports (2014). The first 2 were the general clinical ophthalmology journals that allow original research with the highest IF at the time the study was conducted: *Ophthalmology* (IF, 6.135) and *JAMA Ophthalmology* (IF, 4.399). The second 2 journals were the subspecialty clinical ophthalmology journals with the highest IF: *Retina* (IF, 3.243) and *Journal of Glaucoma* (IF, 2.106). The last 2 journals were the general basic research-oriented ophthalmology journals with the highest IF: *Investigative Ophthalmology and Visual Science* (IF, 3.404) and *Experimental Eye Research* (IF, 2.709).

Study Period

The study was conducted in June 2015. The publication period considered was January 1, 2002, through December 31, 2014. This period was chosen because on January 1, 2002, PubMed started to publish the full names, including first names, of all authors, which allowed us to identify the authors' genders in most cases. We selected only those articles that also included an abstract to eliminate articles such as letters, editorials, and comments that do not constitute original research. No author or article was excluded because of the country of residence or affiliation of authors.

Author Name Retrieval

A computer script was programmed (Visual Studio 2013 C#; Microsoft Corporation, Redmond, WA) that allowed retrieval of all names of all authors in every article and the position of each author in the authors' list. The position of an author was categorized as either first author or last author. All other authors were designated as middle authors. Whenever a group of authors was defined as a collaborative study group (e.g., Diabetic Retinopathy Clinical Research Network), that group and position (if it was listed first or last) were excluded from the analyses because gender could not be assigned for a group; authors in other positions for that same article were included.

Assignment of Author Gender

To assign the gender of each author, we used a Google-based program (Baby Name Guesser; available at: http://www.gpeters.com/names/baby-names.php) that uses Google's database to analyze common patterns involving first names. This program was used to analyze trends in dermatology manuscript authorship over time.[10] The program determines whether the name is used more commonly for a man or a woman from popular usage on the Internet and provides the ratio that a given name is used for a specific gender. For instance, "Michael" is 7.527 times more common in men than in women. For the purpose of analysis, we arbitrarily considered a specific name to be that of a man or a woman if the program provided a ratio of more than 3 to 1 (3.0). In case the ratio was less than 3.0, the specific author and his or her position were not included in the analysis; however, other authors listed on that article with a ratio of 3.0 or more remained included. Confirmation of correct gender assignment was performed for the first 100 authors by using the Internet home page of the author's institutional affiliation and the Google search engine; the assigned gender was found to be correct in all cases. Similarly, manual assignment of 100 random unassigned authors from each journal category in the years 2002 and 2012 was performed separately ($n = 100 \times 3 \times 2 = 600$). The percentage of manually assigned women authors in each research category in 2002 and 2012 was clinical, 29% and 35%, respectively; basic, 33% and 40%, respectively; and subspecialty, 29% and 30%, respectively.

Statistical Analyses

Data were analyzed with Minitab Software version 16 (Minitab, Inc, State College, PA). Chi-square analyses were performed to compare the percentage of women authors among the 3 categories of journals (general, basic, subspecialty) and author positions (first, middle, last). Linear regression was used to analyze the trend in proportion of women authors over time. A separate analysis was conducted for each author position and for each type of journal. To compare slopes of the regression lines, an analysis of covariance (ANCOVA) was performed. A stepwise binary regression analysis was performed to identify factors associated with the gender of the author. A P value of less than 0.05 was considered statistically significant.

Results

Overall, 23 026 articles were analyzed throughout the study period, of which 10 291 (44.7%) were from clinical ophthalmology journals, 12 735 (55.3%) were from basic ophthalmology research, and 3761 (16.3%) were from subspecialty clinical journals (Table 1). Of 136 855 author names that were collected for all studies, 102 231 were included in the final analyses after excluding 34 624 (25.3%) because of uncertainty regarding author gender. The distribution of the ambiguous author names was homogeneous across all study years and ranged between 23% and 26%. The percentage of women authors was 34.7% in clinical journals, 36.8% in basic journals, and 30.6% in subspecialty journals.

Figure 1 depicts the percentage of women authors (all, first, and last) throughout the study period in all 6 journals combined. There was a significant rise in the percentage of women authors over time, with a steeper slope for first authors (0.75) than for last authors (0.40) or all authors (0.52; $P<0.001$, ANCOVA). In 2014, women authors still represented less than 50% in all categories of authorship.