Trends in Authorship Demographics for Manuscripts Published in *The American Journal of Cardiology*

Nigel Amankwah, BSc[a], Mindy Park, BA[a], Alex Gu, BSc[a], and Brian G. Choi, MD, MBA[b,*]

The demographics of authors in manuscript publications have been investigated in many specialties but not yet cardiology. We explored the authorship trends in *The American Journal of Cardiology*, a fundamental journal in this field, to uncover the historical demographic patterns in the field. Manuscripts published in 1958 (the first year of publication), 1966, 1976, 1986, 1996, 2006, and 2016 were analyzed. Parameters used were gender of first and last authors, number of authors per article, the authors' qualifications and country of corresponding authors. A total of 4,329 articles were analyzed. We hypothesized an increase in authors per article, variety of authors' degrees, countries contributing to authorship, and an increase in female authorship over time. We found that the mean number of authors per article increased from 1.8 in 1958 to 8.6 in 2016. Qualification varieties of first and last authors also increased, particularly first and last authors holding degrees in MD/PhD and first authors holding masters degrees. Female first and last authorship showed an increase. In 1958, female first authors comprised of 3.0% of all the publications compared with 23% in 2016. Similarly, female last authors accounted for 5.2% of all publications in 1958 compared with 20% in 2016. There was also an increase in articles originating from Europe and Asia. In conclusion, there has been a significant increase in authors per article, variety of author degrees, and contribution from international authors. Despite the relative lack of increase in female cardiologists compared to physicians in other specialties in the United States, female authors in *The American Journal of Cardiology* have increased significantly over this 58-year time period, surpassing the 13% overall female representation within this specialty. **(Am J Cardiol 2018;122:1255–1259)**

The study of authorship demographics has gained interest because of increased diversity within medicine and publications' value in post-graduate education and subsequent academic careers.[1–4] Analysis of other specialties showed an increase in international authors and authors with various qualifications overtime.[5–7] Although women now represent more than half of medical students,[8] there has been a relative lack of growth in the number of female cardiologists, constituting only 13% of all United States cardiologists in 2013.[9] In this study, trends in the authorship of manuscripts published from 1958 to 2016 were analyzed from *The American Journal of Cardiology* (AJC). Parameters set were (1) gender of published first and last authors, (2) number of authors per article, (3) the authors' qualifications, and (4) the country of the authors' affiliated groups. We hypothesize that over time; there will be an increase in authors per article, variety of authors' qualifications, countries contributing to authorship, and an increase in female authorship.

Methods

Manuscripts published in AJC from 1958 (the first year of publication), 1966, 1976, 1986, 1996, 2006, 2016 were reviewed from the journal's list of issues.[10] The article exclusion criteria were editorials, book reviews, proceedings, and in memoriam. Information taken from each article were number of authors, gender of first and last author, academic degree(s) of first and last author (or their American equivalent). Country of the corresponding author was used to determine where the study was conducted. All author locations were categorized into Europe, Middle East, Asia, North America, and Other. Middle East encompassed publications originating from Israel, Turkey, Saudi Arabia, and Egypt. Other included articles from South America and Africa. Google search concurrent with author's institutional affiliation was used to determine the first name for articles in which only the author's initial was published. Exclusion criteria for authors were (1) if only the first name initial of the author was reported then a Google search was conducted to determine the full first name of the author but if the Google search was unsuccessful the author was excluded from the analysis, and (2) if a degree was not listed then the author was excluded from degree analysis.

A validated program was used to determine each author's gender by analyzing a database of first names.[7,11,12] The program tallies the author's name against a large database of names (from multiple data sources across 178 different countries) to determine corresponding gender.[13] At the end of each analysis an accuracy value is

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*Corresponding author: Tel: 202-741-2323; fax 202-741-2324.
E-mail address: bchoi@gwu.edu (B.G. Choi).

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reported. For more gender ambiguous names, an accuracy above 50% with its associated gender was used. For example, "Peyton" is 56% more likely to be a female than male.

Statistical Package for the Social Sciences (SPSS; Version 22; Armonk, New York) software was used to conduct chi-square analysis on number of articles, number of authors, country of origin, first and last author degrees, and genders. Order of the degrees was set from highest to lowest as such: MD and PhD to hold highest degree in their respective fields, after by Master's and Bachelor's degrees. To standardize degrees, international degrees that allowed the participant to practice the corresponding profession in their respective country was converted to the American degree equivalent, such as an MBBS degree in England was considered to be the American equivalent of an MD. If an author had several degrees (and it was not analyzed in a combination group such as MD/PhD), only the highest academic degree was considered. For example, an author with credentials of MD, Master's, BSc would be categorized as an MD. In addition to these parameters, the chi-square tests also compared proportion of first/last authors with a specific degree to the first/last authors who published in that same year. For example, all first/last authors in 1958 with an MD as their highest degree were compared with the total number of first/last authors in the same year. Chi-square test was also used to analyze the trend of female authorship based on author positions (first/last). Last, the differences in the number of authors were evaluated using analysis of variance and post hoc Turkey's test. A $p < 0.05$ was considered to be significant.

Results

A total of 4,329 articles was analyzed. The respective number of articles in each year was as follows: 1958, n = 236; 1966, n = 344; 1976, n = 648; 1986, n = 792; 1996, n = 799; 2006, n = 854; 2016, n = 656. Mean number of articles per author increased from 1.8 in 1958 to 8.6 in 2016 (Figure 1).

The results of first and last authorship degrees exhibited parallel trends over the same period of time. There was a significant increase in first authors holding degrees in MD/PhD and Master's degrees. In 1958, 0.9% of all first authors held an MD/PhD compared with 12% in 2016 ($p < 0.01$). Similarly, first authors with a Master's degree comprised 0.0% in 1958 compared with 1.6% in 2016 ($p < 0.05$). The number of first authors with only an MD increased prior to 1986 but then decreased between 1986 and 2016; however, the percentage of MD first authors in 1958 to 2016 decreased from 97% to 69% (Figure 2). Last authors holding MD/PhD ($p < 0.05$) and PhD ($p < 0.05$) increased over the study period. However, last authors with Master's degree remained unchanged over the same time period ($p < 0.1$). Last authors with MD/PhD increased from 2.0% to 23% between 1958 and 2016. Last authors with PhD only comprised 4.1% in 1958 but increased to 7.6% in 2016. Last authors with a Master's degree remained unchanged at 1.0%. Similar to first authors, last authors with MD degrees decreased from 92% in 1958 to 57% in 2016 (Figure 3).

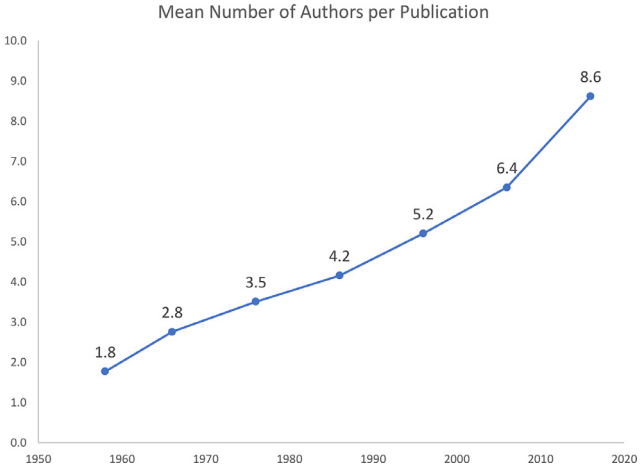

Figure 1. Mean number of authors per article from 1958 to 2016.

The trend for female first and last authorship showed significant increases, respectively (both $p < 0.05$). In 1958, female first authors comprised 3.0% of all the publications as compared with 23% in 2016 (Figure 4). Similarly, female last authors accounted for 5% of all publications in 1958 and 20% in 2016 (Figure 5).

The geographical authorship distribution showed mixed results; some geographic locations contribution increased significantly and others showed no change. The number of publications from Europe increased from 2.5% in 1958 to 27% of all publications collected in 2016 ($p < 0.001$). Similarly, authors from Asia rose from 0.4% to 13% of all publications between 1958 and 2016 ($p < 0.001$). Other ($p < 0.1$), Australia ($p < 0.1$), and Middle East ($p > 0.1$) showed no change in proportion of contribution (Figure 6).

Discussion

The main aim of the study was to illuminate the demographic trends in authorship of manuscripts published in the AJC from 1958 to 2016. We observed that the average number of authors per manuscript over the selected time period increased. The increase in number of authors for each manuscript over time has been hypothesized to be multifactorial including the growing complexity of research, the increased demand for collaborative research, and the drive to increase competitive eligibility for coveted residency and fellowship spots.[1,14–19] There is increasing competition at all levels of academia, which places pressure on MD candidates to find new ways to bolster their resumes. To be more competitive, trainees at all levels try to distinguish themselves from their peers through publications.[20] This phenomenon may also explain the increase in variety of first author degree qualifications over time as opposed to solely MD degree as more medical students are publishing earlier on in their careers.

A significant increase in the contribution of Europe and Asia was seen over time. This observation may be explained by the rise in international research collaborations between the United States and different countries. A report by the US-based National Science Foundation indicated that US authors collaborated mostly with authors from China, compared with other countries. Europe exhibited the highest percentages of international collaboration