

RESEARCH LETTER

Association Between Female Corresponding Authors and Female Co-Authors in Top Contemporary Cardiovascular Medicine Journals.

AQ9

Despite progress in the representation of women in medical training, women continue to be underrepresented in cardiology, medical literature, and leadership positions in academic medicine.¹ While over 50% of matriculating medical students are women, they make up less than a quarter of US general cardiology fellowship trainees and 12% of practicing general cardiologists.¹ In academic cardiology, female authors are underrepresented among authors in cardiology journals and authors of R01-funded research manuscripts.² Identifying disparities in research productivity and acknowledgment can highlight barriers to female representation in academic cardiology leadership and academic promotion. Corresponding authors on manuscripts typically lead and organize research projects, and representation of female researchers in this role may be an important marker for female representation in academic cardiology. We hypothesized that female representation as corresponding authors lags behind overall representation in research, but that female researchers in corresponding authorship roles may be associated with more female representation in research manuscripts.

Our analysis used a bibliometric approach to analyze the authorships of manuscripts from the 20 top impact cardiology journals of 2017. Using citation data extracted from PubMed by the Entrez database, we identified relevant manuscript and authorship data from all articles published in these journals in 2017. For all authors with a complete name listed, gender was determined by matching first name with gender using a previously validated Genderize database containing 216 286 distinct names across 79 countries and 89 languages.³ Author names not found in the Genderize database were compared with historical datasets from the US Social Security Administration, the US Census Bureau, and the North Atlantic Population Project to further match less common names.⁴ Sensitivity analyses were performed on the confidence of matching gender to name by excluding all nonconfident matches and by assuming extreme case scenarios of the gender distribution of unmatched names. These analyses did not significantly affect the study results. Student's *t* test and χ^2 test were used to determine significant differences between groups. Statistical analyses were performed using R 3.4.2 (R Foundation, Vienna, Austria) and were based on 2-sided tests with a significance level of 0.05. This study was IRB exempt using only publicly available data. The data, analytic methods, and study materials have been made available for purposes of reproducing the results.³

We extracted a total of 2379 articles from the top 20 impact cardiology journals of 2017 with full author names and corresponding authorship information on PubMed. Of 10 646 unique authors, we were able to match gender to 9597 (90.1%) authors. Of the 9597 unique authors, of which 2800 (29.2% were female). There were 445 single-author publications, of which only 67 (15.1%) manuscripts were written by a female author. Among publications with multiple authors, the majority of corresponding authors were the manuscript's first author (98.6%)

David Ouyang, MD
Robert A. Harrington, MD
Fatima Rodriguez, MD,
MPH

AQ1

Key Words: academic cardiology
■ gender disparities ■ women in
cardiology

AQ2

© 2019 American Heart Association, Inc.

<https://www.ahajournals.org/journal/circ>

AQ3

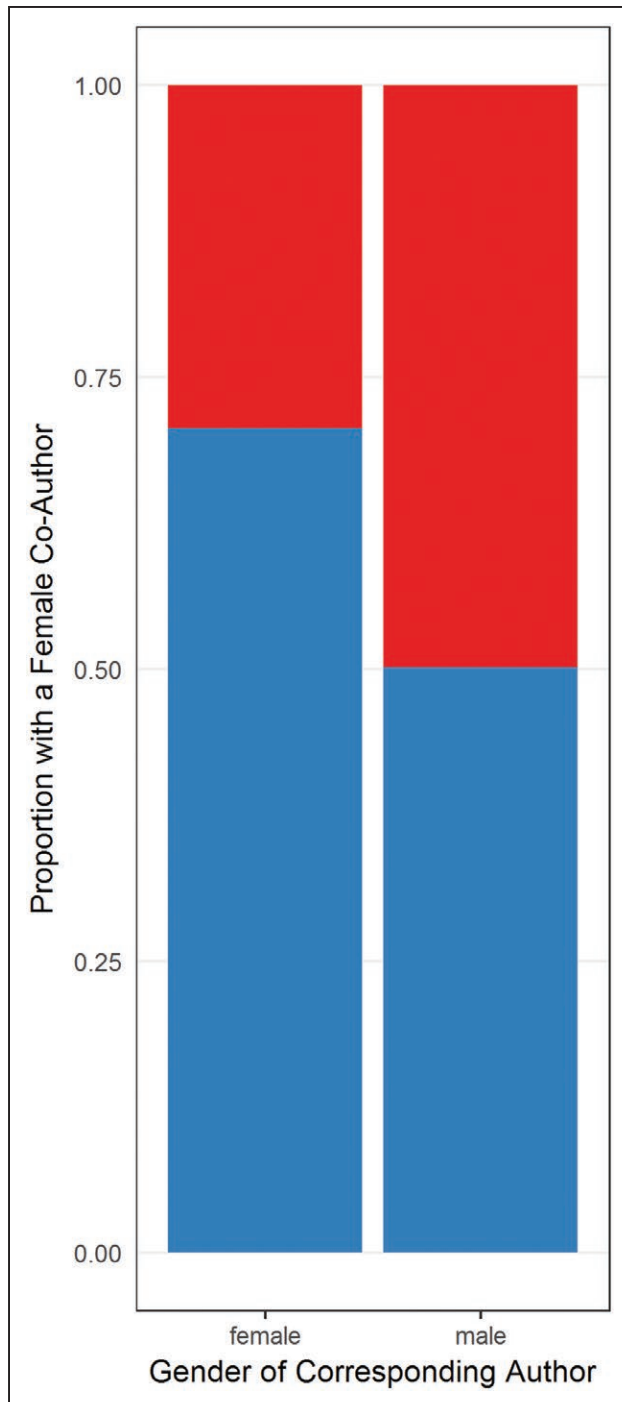


Figure. Proportion of manuscripts with a female coauthor by whether the corresponding author was female or male.

in the authorship list, with the remainder being the last author. While there was no difference in the number of coauthors between the manuscripts with female corresponding author and male corresponding author (9.2 versus 9.6, $P=0.70$), there were significantly more female coauthors when the corresponding author was female (1.8 versus 1.1 female authors, $P<0.001$). There was a similar difference in the number of female coauthors when only including authors with the highest

confidence in matching name to gender (2.2 versus 0.7 female authors, $P<0.001$), as well as, sensitivity analyses in which we assume all unclassified names were male (1.8 versus 1.1 female authors, $P<0.001$) or when we assume all unclassified names were female (2.2 versus 1.3 female authors, $P<0.001$). Seventy-one percent of manuscripts with a female corresponding author had another female coauthor, while only 50% of manuscripts with a male corresponding author had a female coauthor (Figure, $P<0.001$). Manuscripts with female corresponding authors were also more likely to have female last authors ($P=0.01$).

Our study supports and extends prior work showing that women, particularly women in underrepresented medical specialties such as cardiology, are less likely to be represented in academic literature. This effect is mitigated in literature with women in leadership roles in research as shown by women as corresponding authors. When women served as corresponding author, they published manuscripts with more female last authors, are more likely to have female coauthors, and had more female authors. Previous literature has shown that lack of positive role models may be a reason for the underrepresentation of women in cardiology.⁵ Our study suggests that in a research setting, female investigators are likely also serving as mentors for other female researchers. Women in leadership positions in academic cardiology will in turn serve as positive role models to recruit and retain talented junior female investigators. In addition to recruiting more women into the field of cardiology, additional work is needed to identify and address barriers to academic advancement for female physician-scientists.

ARTICLE INFORMATION

Correspondence

David Ouyang, MD, Stanford University Falk Cardiovascular Research Center, 870 Quarry Rd Ext, Palo Alto, CA 94305. Email ouyangd@stanford.edu

Affiliations

Department of Medicine, Stanford University School of Medicine, Stanford, CA. (D.O., R.H., F.R.). Division of Cardiovascular Medicine, Stanford University School of Medicine, Stanford, CA. (D.O., R.H., F.R.).

Sources of Funding

Dr Ouyang is funded by a Translational Research and Applied Medicine Pilot Grant.

Disclosures

None.

REFERENCES

1. Rodgers GP, Conti JB, Feinstein JA, Griffin BP, Kennett JD, Shah S, Walsh MN, Williams ES, Williams JL. ACC 2009 survey results and recommendations: Addressing the cardiology workforce crisis A report of the ACC board of trustees workforce task force. *J Am Coll Cardiol*. 2009;54:1195–1208. doi: 10.1016/j.jacc.2009.08.001

2. Lerchenmüller C, Lerchenmueller MJ, Sorenson O. Long-term analysis of sex differences in prestigious authorships in cardiovascular research supported by the National Institutes of Health. *Circulation*. 2018;137:880–882. doi: 10.1161/CIRCULATIONAHA.117.032325
3. Ouyang D. GitHub. <https://github.com/douyang/>. Accessed November 23, 2018.
4. Blevins C, Mullen L. “Jane, John ... Leslie? A Historical Method for Algorithmic Gender Prediction,” *Digital Humanities Quarterly* 9, no. 3 (2015).

<http://www.digitalhumanities.org/dhq/vol/9/3/000223/000223.html>. Accessed XXXX XX, XXXX.

5. Douglas PS, Rzeszut AK, Bairey Merz CN, Duvernoy CS, Lewis SJ, Walsh MN, Gillam L; American College of Cardiology Task Force on Diversity and Inclusion and American College of Cardiology Women in Cardiology Council. Career preferences and perceptions of cardiology among US internal medicine trainees: factors influencing cardiology career choice. *JAMA Cardiol*. 2018;3:682–691. doi: 10.1001/jamacardio.2018.1279

AQ7

CORRESPONDENCE

AUTHOR QUERIES

Authors please note: Authors are responsible for any page charges as outlined in the acceptance letter or as indicated on the Instructions for Authors (<http://circ.ahajournals.org/content/accepted-manuscripts>). Unless you have selected open access for your article, or it is otherwise noted on the acceptance letter, page charges are as follows: \$70 per black and white page (print articles only) or \$35 per page (online-only articles only). For each color page (print only), please add \$653/page. If there are any concerns regarding these charges, these should be addressed within 48 hours of receiving the s-proof. Author(s) will be invoiced for all color and page charges post publication. If you have selected open access for your article, please refer to details in the queries below.

AUTHOR PLEASE ANSWER ALL QUERIES

- AQ1—For indexing purposes, confirm author names have been correctly identified as given names (blue), surnames (red), and suffixes (black). Color in the byline will not appear on the final published version.
- AQ2—Key words have been edited to match the US National Library of Medicine's Medical Subject Headings (<http://www.nlm.nih.gov/mesh/MBrowser.html>). If they need modification, please refer to this site and limit the total number of key words to 7.
- AQ3—Please expand IRB.
- AQ4—You should have received a letter with your Welcome Kit indicating the new price structure for color figures. If you have color in your proof, please indicate whether you approve the color charge when you return your proof corrections. The rate is \$653 per 1 printed color page. If you have any questions, please contact "mailto:circulationjournal@lww.com"
- AQ5—Please confirm that all authors' institutional affiliations (including city/state/country locations) are correct as shown in the affiliations footnote.
- AQ6—Please carefully review any Acknowledgments, Sources of Funding, and/or Disclosures listed at the end of the manuscript (before the References), and confirm that they are accurate and complete for all authors.
- AQ7—Please add the date that the website in reference 4 was accessed for research.
- AQ8—Please turn to page 2 of your proof and review the author's name and short title in the running head. Short titles must be 50 or fewer characters in length, including spaces and punctuation. If your original short title was longer than 50 characters, we may have shortened it. Please modify if necessary (but observe our length guidelines).
- AQ9—Please confirm that all authors are included in the correct order in the byline and that all names are spelled correctly, including special characters, accents, middle initials, and degrees, if applicable. Note that journal style discourages listing honorary degrees (FAHA, FRCP, etc.) in the byline; please delete such degrees from the author byline.