BRIEF REPORT

Gender Disparities in Cardiology-Related COVID-19 Publications

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ABSTRACT

Introduction: Female authors are underrepresented in cardiology journals, although prior work suggested improvement in reducing disparities over time. Early in the recent COVID-19 pandemic, female authorship continued to lag that of their male counterparts despite a surge in publications. The cumulative impact of the COVID-19 pandemic on authorship gender disparities remains unclear. We aimed to characterize gender disparities in COVID-19-related cardiology publications across the duration of the ongoing pandemic.

Methods: We retrospectively analyzed COVID-19-related research articles published in the top 20 impact factor cardiology journals between March and June 2021. Gender representation data were extracted for any author, first authors, and senior authors.

Results: We found that 841 articles were related to COVID-19, with a total of 5586 authors and an average of 42 articles per journal. Less than a third (29.9%) of the total authors from publications were women. Women represented a smaller proportion of first authors (21.3%) and senior authors (16.4%).

Conclusions: Female authorship has continued to lag male authorship for the duration of the ongoing COVID-19 pandemic. The pandemic may have impeded progress in reducing gender disparities in academic cardiology publications. The low proportions of first and senior female authors may reflect the impact of the pandemic on women in cardiology in leadership domains.

Keywords: Cardiology; Scientific publishing; Women; Gender disparities; COVID-19; SARS-CoV-2

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Key Summary Points

The cumulative impact of the COVID-19 pandemic on disparities in gender authorship is unknown and has important implications for career advancement for women in cardiology.

Among COVID-19 cardiology-related articles in top cardiology journals, female authorship has persistently lagged behind that of their male counterparts, with female authors representing less than a third of total authors and even lower proportions of first and senior authors.

These trends have been sustained for the duration of the COVID-19 pandemic and may impede future progress in reducing gender disparities in academic cardiology publications.

INTRODUCTION

Women physicians are underrepresented in academic medicine [1], with more pronounced disparities in cardiology, where women constituted only 14% of the workforce in 2017 [2]. Authorship trends in top cardiology journals reflect this gender disparity, although prior work indicated that this gap may have been improving over time. Among high-impact cardiology journals, 9.5% of articles between 1980 and 1986 had female first authors, compared with 26.2% of articles between 2010 and 2017 [1]. During the recent COVID-19 pandemic, despite rapidly accelerating rates of COVID-19-related publications, the proportion of male authors continued to exceed their female colleagues in cardiology-related research [3]. Early in the pandemic, a study of a subset of four high-impact journals found that the proportions of female first or senior authors in COVID-19-related manuscripts were slightly higher compared with authorship trends in 2019 [4]. The updated cumulative impact of the ongoing

pandemic on gender authorship disparities remains unclear. We evaluated gender disparities in COVID-19-related publications in top cardiology journals across the duration of the pandemic with attention to first and senior author roles.

METHODS

We performed a retrospective analysis of articles published in the top 20 impact factor journals in cardiology from March 1, 2020, to June 13, 2021, with the key words *COVID-19* or *SARS-CoV-2* in the title [1, 5]. We used RISMed for article extraction, a software package which accesses PubMed, an online database of over 27 million citations of medical literature maintained by the National Center for Biotechnology Information at the US National Library of Medicine. Citation data, including PubMed ID, article type, article title, date of publication, and authorship list, were extracted on June 13, 2021.

The first author, senior author, and up to 15 total authors were identified based on author list ordering. For all authors with a complete first name listed, gender association was determined by matching first name using a validated database, Genderize, used in prior analyses [1, 5]. Any author name with less than 60% male or female association by Genderize was excluded [6]. Chi square goodness-of-fit tests were used for comparisons between groups. Statistical tests were performed using RStudio 1.3.959 (RStudio, PBC, Boston, MA, <https://rstudio.com/>). Data were publicly available; therefore, the study was IRB-exempt. This article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

RESULTS

We extracted a total of 47,372 articles from the top 20 impact cardiology journals during the study period. Impact factors ranged from 5.7 to 20.4. Of these, 841 articles were related to

Fig. 1 Proportion of male and female authors in any authorship position in COVID-19-related articles published in the top 20 impact cardiology journals between March 1 and June 13, 2021

COVID-19, with a total of 5586 authors. There was an average of 42 articles per journal, with a range of 6–152. Gender was ascertained in 99.4% of authors included in this study. Less than a third of the publications were authored by women (29.9%) in any author position ($p < 0.01$).

Temporal publication trends by author gender and author position are shown in Figs. 1 and 2. Due to the rapidly changing academic landscape during the COVID-19 pandemic, we believed our findings would be best summarized as proportions on a monthly scale. In any author position, there was a monthly average of

104 female authors represented in top COVID-19 cardiovascular publications, compared with 243 male authors. Of 3522 first authors, 21.3% were women ($p < 0.01$). Of 2691 senior authors, approximately one in six (16.4%) were women ($p < 0.01$).

DISCUSSION

Our findings highlight persistent gender publication disparities among COVID-19-related cardiology articles despite a major influx of COVID-19-related articles in high-profile cardiology journals during the pandemic. Women in

Fig. 2 Proportion of male and female authors in first author position (**A**) and in senior author position (**B**) in COVID-19-related articles published in the top 20 impact cardiology journals between March 1 and June 13, 2021

any author position represented less than a third of publications, and an even smaller proportion of first and senior female authors. An analysis of research articles in four major cardiology journals early in the COVID-19 pandemic revealed that representation of women as first or senior authors of any article type of non-COVID-related papers increased from March to June 2020 compared to 2019 [4]. In COVID-19-related cardiology papers, women represented similar proportions of first and senior authors to non-COVID-related papers; however, they were significantly less likely to be first authors of COVID-19-related original research articles. Our study extends this finding by including a broader group of cardiology journals across an updated, longer pandemic time frame, suggesting that the impact of COVID-19 on the academic careers of women may be durable.

Our findings build on prior work by our group showing that one-third of journal articles published in the top 20 impact cardiology journals between 1980 and 2017 were authored by women [1]. In that study, we found that the proportion of female authorship in cardiology

journals increased over time, with female first authorship increasing to 26.2% and female senior authorship increasing to 17.4% by the 2010–2017 period. In 2020, among the top four impact cardiology journals, women were first authors on 27.4% of manuscripts and senior authors on 19.3% manuscripts. Compared with these findings, proportions of female first authorship (21.3%) and senior authorship (16.4%) from 2020 to 2021 in the present study are similar and do not suggest continued improvement in reducing gender authorship disparities, although the study cohorts differed. The actual proportions of first and senior authors may be lower than 21.3% and 16.4%; our study includes all female authors of COVID-19-related articles in cardiology journals, some of whom may not be cardiologists. Our results raise the hypothesis that the COVID-19 pandemic may have attenuated progress in reducing authorship gender disparities and warrants continued monitoring of publication trends.

The low numbers of women in first and senior author positions across a large number of journals may reflect additional barriers in

pursuing authorship roles with more seniority or time commitment during the COVID-19 pandemic. This may have implications for women in academic cardiology leadership domains during and after the COVID-19 pandemic. Senior authors tend to hold higher-ranking positions, such as senior professors or department chairs [7].

Additionally, first authors historically offer the highest levels of contribution to the conception and production of a manuscript [8]. The long-term impact of the pandemic on gender disparities among first and senior authorship roles and academic cardiology leadership positions may warrant close study.

There are several explanations for our findings as highlighted in other studies and recent press reports. Female scientists, especially those with young children, reported less time devoted to research during the pandemic than their male counterparts [9]. Women may also face increasing nonacademic professional demands that compete with academic productivity. As we continue to investigate the cardiovascular complications of COVID-19, mechanisms that promote gender equity in academic cardiology must address the unique challenges that female cardiovascular researchers may face during the pandemic.

Limitations of our study include that our statistical query is limited to one database (PubMed) and the lack of articles published in preprint servers. Additionally, conventional East Asian first names were not reliably matched to sex, which likely underestimates both male and female representation of East Asian cardiologists. However, our analysis targeted a large number and diverse array of journals and article types with the intention of capturing a global audience, and was still able to match 99.4% of authors.

CONCLUSIONS

In conclusion, among COVID-19 cardiology-related articles published in top cardiology journals, female authorship has persistently lagged that of male counterparts for the duration of the ongoing COVID-19 pandemic. The

pandemic may have impeded progress in reducing gender disparities in academic cardiology publications. Disparities among first and senior authorship positions were pronounced and may have implications for academic cardiology leadership domains.

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Compliance with Ethics Guidelines. This article is based on previously conducted studies and does not contain any studies with human participants or animals performed by any of the authors.

Data Availability. The data sets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Prior Presentation. This manuscript is based on work that was previously presented as a poster at the American College of Cardiology's Annual Scientific Session on May 15, 2021 (virtual).

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