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Gender balance at the heart of science

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1. Diversity matters for high impact scientific research

In its essence, scientific and clinical research are working at the boundaries of knowledge. This is a ‘team sport’ requiring integration of many individuals’ work, often spread both spatially and temporally. Insights from large companies show that building a diverse team of people with distinct perspectives and life experiences results in increased creativity, faster problem solving, higher innovation, and more effective decision-making. These key processes are relevant to producing high impact scientific research.

2. Women are under-represented in cardiology

A series of articles published in *Circulation* this year highlighted that women are under-represented across the board in cardiology: as participants in clinical trials,¹ as clinicians,² and in editorial board positions.³ In cardiology, women are less likely to be full professors than men. Furthermore, a study by Khan et al.⁴ reported a striking gender imbalance in leadership positions in academic cardiology programmes in the USA. A markedly lower proportion of division chiefs (5% vs. 95%) and programme directors (14% vs. 86%) were women. In addition, their male counterparts had a higher number of publications and a proportionally higher H-index.⁴ This supports the hypothesis that disparities in research productivity partially accounts for the lower occupancy of women in leadership positions. The most recognizable metric of productivity is the number and impact of peer-reviewed publications. Thus, journals and editors are a key part of the vicious cycle of female under-representation in science (Figure 1). This is known as the ‘Glass Ceiling Effect’, coined by Marilyn Loden in a speech for the Women’s Action Alliance in 1978. It represents an invisible barrier that keeps women and other minorities from rising beyond a certain level in a hierarchy. This article will give an account of the role of women as authors, peer reviewers, and editors in academic cardiology publications. This article

does not seek to give recommendations on how to address the gender imbalance; however, this has been discussed elsewhere.⁶

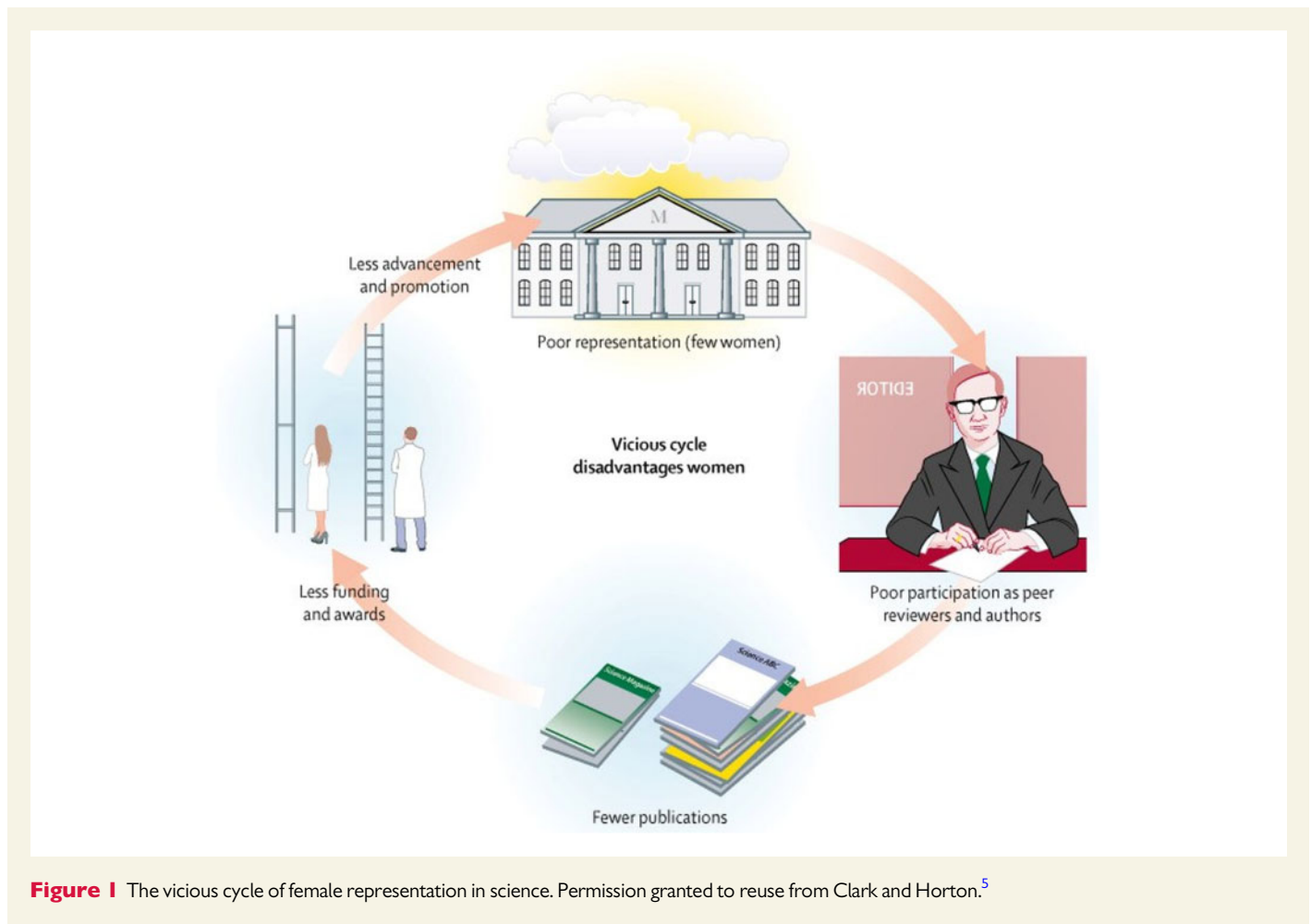
3. Women as authors

A study by Asghar et al.⁷ on six predominantly clinical cardiology journals (*JACC*, *Circulation*, *Am J Cardiol*, *Eur Heart J*, *BMJ Heart*, and *Clin Cardiol*) assessed the evolution of the gender gap in authorship over the last 20 years. Overall, 16.5% and 9.1% women were first and senior authors, respectively. Over the years, there were significant upward trends in both authorships’ positions of 9.5% and 6.6%. This was observed in all journals except for *Eur Heart J*, where a decrease in female senior authorship was present. A longer-term study over 40 years in three of these journals (*JACC*, *Circulation*, and *Eur Heart J*) confirmed these findings, with only 27% and 20% first and senior female authors respectively.⁸ Regarding article type (original, review articles, and editorials), this upward trend was not observed for review articles for the first authorship.⁸

In preclinical research, Labinaz et al.⁹ focused on five journals (*Circulation*, *Circ Res*, *Hypertension*, *Stroke*, and *ATVB*) and reported that the proportion of female first authors was notably higher than in the clinical journals (41.3%) but senior authorship was similarly low (11.0%). Concurrent with the findings in clinical journals, there was an increase in female authorship over the 10-year period of the study. In both clinical⁷ and preclinical research,⁹ papers with a female senior author were more likely to have a first female author. In 2016, the proportion of female first authors in cardiology journals was 21%, much lower than in general medical journals (~30%).¹⁰ For senior authorship, the percentage was even lower, with women composing only 12%. Another striking fact is that only 5% of women are on the top 100 most prolific authors in the top three clinical cardiology journals.⁸

The under-representation of female authors is not unique to cardiology; since 1995, <15% of senior authors published in *Nature* were female.¹¹ In addition, one study calculated that male authors were invited to submit to life sciences journals at approximately double the rate of female authors.¹² A 2018 study by Shen et al. that sought to assess the Neurology field but also included top non-specific Journals such as

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Nature, *Science*, and *PNAS*, showed a negative correlation between the 5-year journal impact factor and the percentage of women as first and last authors.¹³ With regards to impact of research, sensationalistic terms such as 'novel' and 'unexpected' in the title and abstract of a paper increase citations; however, according to a study published in *BMJ* articles from female first-authored papers are 12% less likely to use such wording relative to manuscripts written by men.¹⁴ Psychologists attribute these findings to a known sex difference in self-promotion, where men are more likely to describe their own performance more favourably. In addition, women are subject to the 'likeability penalty' where they are more likely to receive backlash for acting in a way that promotes power or success. In addition, unconscious gender bias by reviewers and editors may result in conclusions being tempered.

In general, overall trends are positive, and the increased involvement of women in the field of cardiology has a key role to achieve gender parity in authorship of cardiovascular research literature. Over time, there has been an increasing proportion of female first authors and female senior authors in cardiology literature, concurrent with the trend in medical literature in general.

4. Women as peer reviewers

Peer review is the lifeblood of scholarly publishing.¹⁵ In the last two years, high impact scientific and medical journals (*Nature*, *Science*, *Lancet* to name a few) have released statements regarding the under-

representation of women as peer reviewers. In medical journals, women provide only 20% or less of peer reviews (<https://www.biorxiv.org/content/10.1101/400515v3>). A study that assessed the *Frontiers* journal family showed that male editors are more likely to select male reviewers; however, women do not appear to show this gender bias.¹⁶

5. Women as editorial board members

Three factors can explain the under-representation of women in editorial boards: the field of study, the journal's impact factor, and the editor's gender. Balasubramanian *et al.* examined major American and European cardiology journals. They reported that women were under-represented among deputy and associate editors; this trend was more pronounced in European journals. In the American journals, the percentage of women on editorial boards doubled over the 10-year period of the study (6.3–12.9%); however, this was still notably low. Of foremost importance is curating an editorial board that suits the scope and needs of the journal. In addition, ensuring diversity can improve the relevance of the journal, reduce publication bias against women and emphasize commitment to equality. All of which have the potential to stimulate submissions of high-quality science. In 2019, *Circulation Research*, *JACC: Case Reports* and *JACC: Cardio-Oncology* appointed female editors-in-chief. They join one other female editor-in-chief of an American cardiology journal,

Circulation: Heart Failure. Among the European Society of Cardiology family, only one of the 15 journals has a female editor-in-chief (Prof Tiny Jaarsma, *European Journal of Cardiovascular Nursing*).

6. Women in ESC initiative

Despite the increase in the number of women studying medicine and life sciences and in most medical fields, including Cardiology, they are still under-represented in leadership positions. There are huge personal and professional benefits to facilitating collegiality among women, including eliminating the likeability penalty, imposter syndrome as well as women not supporting one another through Queen Bee syndrome. One such successful initiative is the Women in ESC programme. The aim of the initiative is to provide tools to women for their own development. The main outreach activity of the committee is through sessions at the ESC Congress and the internationally competitive grant given to attend the Women Transforming Leadership Programme at Said Business School, University of Oxford. At the most recent ESC Congress in 2019, there were three women in key leadership positions during the opening ceremony: Professor Barbara Casadei, President of the European Society of Cardiology; Professor Karen Sliwa, President of the World Heart Association; and Mariell Jessup, Past-President of the American Heart Association. The recently elected President of the American College of Cardiology is also a woman: Athena Poppas.

7. Conclusions

Whilst women remain under-represented in academic cardiology publications, there are positives to take away. Namely, there is an increase over the last decade in female authors, reviewers, and editors. High impact journals have brought the issue of gender equality to the forefront and have put measures in place to balance representation of the sexes. Evaluation and transparent reporting of the results of these measures will be important. The majority of the data presented here has been taken from the USA; there is scope for similar analysis to be carried out in Europe. The situation is most likely similar if not worse in low and middle-income countries. Increasing women's involvement in academic publishing will contribute, in part, towards placing more women in senior positions. In addition, journal editors and reviewers must ask for findings in both sexes in the clinical and preclinical studies that they assess, when this is appropriate.

Authors



Biography: Awardees of the 2019 Women Transforming Leadership Grant from the European Society of Cardiology at the Women Transforming Leadership Course, Said Business School, University of Oxford. Gill Louise Buchanan, Alessia Gimelli, Ruxandra Jurcut, Nina Ajmone Marsan, Stefanie Schuepke, Heather Small, Ana Teresa Timoteo, and Liesl Zuhlke.

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