


# BMJ Open Prospective analyses of sex/gender-related publication decisions in general medical journals: editorial rejection of population-based women's reproductive physiology

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## ABSTRACT

**Objective** To assess whether editorial desk rejection at general medical journals (without peer review) of two clinical research manuscripts may relate to author gender or women's physiology topics. Given evidence for bias related to women in science and medicine, and editorial board attitudes, our hypothesis was that submissions by women authors, on women's reproductive, non-disease topics received differential editorial assessment.

**Design** A prospective investigation of publications, author gender and topics in general medical journals in two issues following the editorial rejections of two clinical research manuscripts by five major English-language general medical journals. The rejected manuscripts (subsequently published in lower impact journals) described research funded by national granting bodies, in population-based samples, authored by well-published women scientists at accredited institutions and describing innovative women's reproductive physiology results.

**Setting** Tertiary academic medical centre.

**Main outcome measures** All clinical research published in the two issues following rejection date by each of the five major general medical journals were examined for first/senior author gender. The publication topic was assessed for its gendered population relevance, whether disease or physiology focused, and its funding. Rejection letters assessed editor gender and status.

**Results** Women were underrepresented as original research authors; men were 84% of senior and 69% of first authors. There were no, non-disease focused publications relating to women's health, although most topics were relevant to both genders. The majority (80%) of rejection letters appeared to be written by junior-ranked women editors.

**Conclusion** Sex/gender accountability is necessary for clinical research-based editorial decisions by major general medical journals. Suggestions to improve gender equity in general medical journal publication: (1) an editorial board sex/gender champion with power to advocate for manuscripts that are well-performed research of relevance to women's health/physiology; (2) an editorial rejection adjudication committee to review

## Strengths and limitations of this study

- Innovative results in two women's reproductive physiology-based manuscripts in population-based cohorts of public health importance were subjected to editorial-only rejection at five high-impact general medical journals.
- We prospectively analysed research publications in two postrejection issues of five general medical journals, documenting author gender (in first and last author positions) and published topics independent of gender.
- This analysis included only 74 original research publications from 10 issues of the five English-language, high-impact general medical journals.
- In order to understand the scope of editorial desk rejection we would also need to assess all *submissions* as well as publications for authorship gender and women's reproductive physiology topics.

author challenges; and (3) gender parity in *double-blind* peer review.

## INTRODUCTION

Rejection by editorial boards or reviewers of publications by women scientist-authors may be due to conscious/unconscious biases related to sex/gender. These publication decisions impede women scientists' career advancements in academia and industry. Furthermore, biases may favour pharmacological and disease-related topics rather than those of physiological discoveries. When these combined biases are applied to women's reproductive physiology related topics, editorial and publication-related decisions increase current gender-related barriers and negatively impact healthcare delivery and women's health around the world.

Women now comprise half of all medical students (eg, USA: 47%, Canada: 56%, UK: 57%), but few women have become senior medical faculty members or medical leaders.<sup>1–7</sup> In a 2014 USA study, women comprised 38% of medical school faculty making up 21% of professors and 16% of deans.<sup>1</sup> Research in medical and science fields has documented that women researchers were promoted more slowly, received fewer awards and recognitions, had lower salaries, lacked appropriate mentors and/or advocates, and faced biases favouring men students and applicants.<sup>5–13</sup>

Although women-authored original research articles have increased, nonetheless ‘lack of continued momentum’ and a continued ‘gender gap in authorship ... particularly among senior authors and editorial commentators’ remain.<sup>9</sup> This analysis determined that the ‘proportion of first authors who were women increased from 5.9% in 1970 to 29.3% in 2004 ( $P<0.001$ ), and the proportion of senior authors who were women increased from 3.7% to 19.3% ( $P<0.001$ ) during the same period’.<sup>9</sup> Major English language general medical journals are the most widely read, highly impactful and media-focussed scientific publications. Publications in these journals, with some of the highest impact factors (IF) in the world, are of greatest benefit to authors’ academic advancement. For example, the *New England Journal of Medicine (NEJM)*, has an IF of 91.245; *Lancet*, 79.321; *Journal of the American Medical Association (JAMA)*, 56.272; *British Medical Journal (BMJ)*, 39.890 and *Canadian Medical Association Journal (CMAJ)*, 8.300.

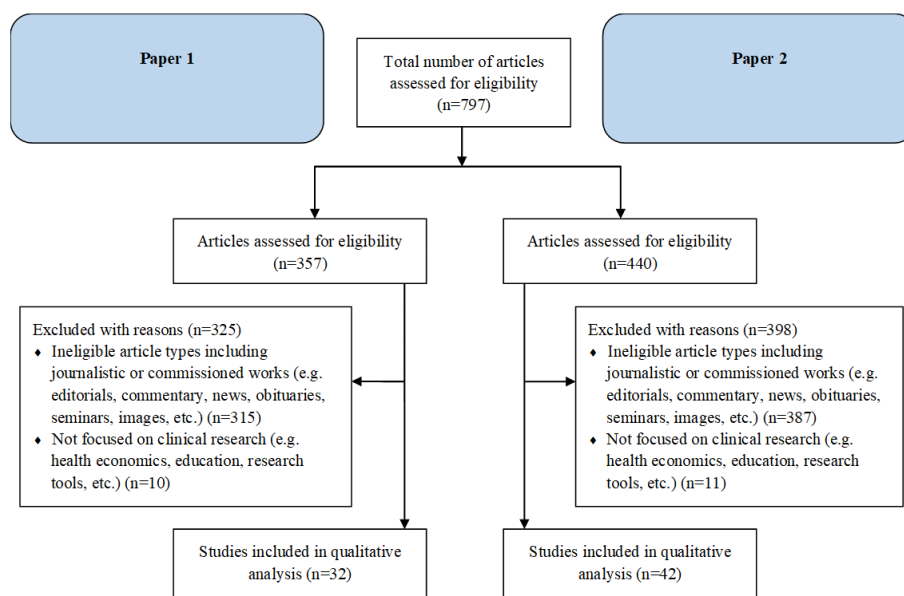
The proportion of women first and senior authors for the *NEJM* and *JAMA* increased from 4.3% (first authors) and 3.9% (senior authors) (for *NEJM*) and 5.7% and 2.9% (*JAMA*) in 1970 to 14.1% and 11.3% (*NEJM*) and 26.5% and 13.6% (*JAMA*) in 2004. Women’s authorship of guest editorials increased from 1.5% in 1970 to 20.4% in 2000, but decreased to 11.4% in 2004.<sup>9</sup> In a review of women’s first authorship from 1994 to 2014, in six high-impact medical journals (including *Annals of Internal Medicine*, IF 25.390) it increased from 27% to 37% but plateaued and declined between 2009 and 2014.<sup>14</sup> In an invited commentary for *JAMA Internal Medicine*, Erren *et al* performed a follow-up analysis of women author representation at six general medical journals in 2010 and 2011 and found that, for original research, women as first authors ranged from 27.3% (*NEJM*) to 46.7% (*BMJ*) but for last/senior authors, women’s representation was 18.3% (*Lancet*) to 28.8% (*BMJ*).<sup>15</sup> Although there continues to be an upward trend in the proportion of women in first and senior author roles in major general medical journals, lack of gender parity in authorship continues. A recent investigation of all *The Lancet* journals between 2014 and 2017 found that one-third of authorship was by women, but the majority of last/senior author positions were men for most of the journals.<sup>16</sup>

*Nature* (IF 42.779), has assessed issues related to women in science. In reviewing its 2012–2013 and 2014–2016 publishing, *Nature* found that few ‘News & Views’ articles

were women-authored; this improved from 12% (in 2011) to 25% (in 2016).<sup>17</sup> It is possible that one reason for fewer women’s commentaries was that *fewer recommended reviewers* were women. From 2011 to 2014, the percentage of women recommended as *Nature* reviewers increased from 14% to 23%; it had decreased by 2016, however, to 12%.<sup>17</sup> A *Nature* analysis of a geophysical journal in 2017 noted women reviewers were suggested fivefold less often than men by editors and by both men and women authors.<sup>18</sup> Despite the journal’s concerted intent, women remain poorly represented in *Nature*, leading to less diversity of ideas and expertise.<sup>17</sup> Women have become a higher proportion of first authors on cardiovascular and life science publications in the past decade (5%–20%).<sup>19</sup> However, this increase occurred only in low impact general medical journals.<sup>19</sup> On a global scale, women are coauthors on fewer than 30% of all scientific publications.<sup>20</sup> Women’s first-authored publications are less cited,<sup>21</sup> despite being more likely to include the ideal, now recommended, sex/gender analysis.<sup>22</sup> While gender-referenced research and gender-associated research by women are encouraged, implicit bias in addition to existing structural and societal biases do not favour women whose research topics are focused on women’s health, with women participants.<sup>23</sup> Authorship of publications allows women to share and promote their research. Most importantly, high-impact journal publication determines newsworthiness and, without this, translation is impeded from research into knowledge and hence into healthcare.

Although there have been many investigations regarding gender bias in women’s *authorship*, few have examined high-impact general medical journals for *publication topic bias*. We hypothesised that publications focused on diseases and their treatments would be preferred over new physiological observations. Gayet-Ageron *et al* recently showed that, not only were women authors less likely in general, they were particularly less likely to be authors on recent COVID19-related research.<sup>24</sup>

Decisions made at the editorial board level have reportedly been linked to fewer publications and less knowledge concerning women’s health.<sup>25</sup> Thus, biases in medical research publication may negatively influence the clinical care women receive. For these reasons, we identified two focal women’s reproductive health physiology, both population-based studies with women first/senior authors, published in 2015 and 2018<sup>26 27</sup> (in low impact journals after 1–2 years of delay) *that were systematically rejected without peer review by all five high-impact English-language general medicine journals: BMJ, CMAJ, JAMA, The Lancet and NEJM*. One submission received reviews within 7 days (more likely by editors than peer reviewers). The studies on which these manuscripts were based were both funded by highly competitive national research grants and both identified previously undocumented, innovative women’s reproductive and bone physiology—one showed for the first time in population-based data that adolescent use of combined hormonal contraceptives impairs peak



**Figure 1** Preferred Reporting Items for Systematic Reviews and Meta-Analyses literature review of clinical research published in two issues of five major general medical journals immediately following editorial rejection date of two focal women's reproductive physiology, population-based studies (papers 1 and 2).

bone mass; the other documented that the point prevalence of ovulatory disturbances was 24%–37% in normal-length cycles in over 3000 women.<sup>26 27</sup> Our purpose in undertaking the present research was to determine what *was* published by these general medical journals in two issues following each of the editorial desk rejections of the focal studies and to use data to assess gender bias<sup>28</sup> related to women authorship and women's reproductive physiology topics. (The details of editorial rejection are provided for each manuscript in online supplemental tables 1 and 2.)

## METHODS

### Study design and data

Using the journal-specific rejection dates of these two articles in online supplemental tables 1 and 2, we reviewed the next two issues to investigate the gender of first and senior (final) authors, the range of original research topics and the funding of each. We further examined the gender of the editorial desk member writing the rejecting letter and the gender of the current editor-in-chief at each time point.

### Analytic approach

We reviewed all publications in two issues postfocal article rejection at each major medical journal. The search flow is shown in figure 1. Each article was checked to determine whether it was commissioned or science-based. Of 797 articles, 702 were excluded as in-house, commissioned or not original research (eg, obituaries, clinical images). Of the remaining 95 articles, a further 21 were excluded (independently by two clinicians) due to their focus on health economics or medical education.

For each included original research article, we gathered gender data on first (usually a junior scientist who wrote the manuscript) and senior/final authors and the topics and their relevance for men only, women only, or women and men in the population. We used content analysis to assess whether each topic related to a disease process, its treatment or normal physiology, and the sex/gender and age (eg, paediatrics) of its population relevance.

### Assigning author gender

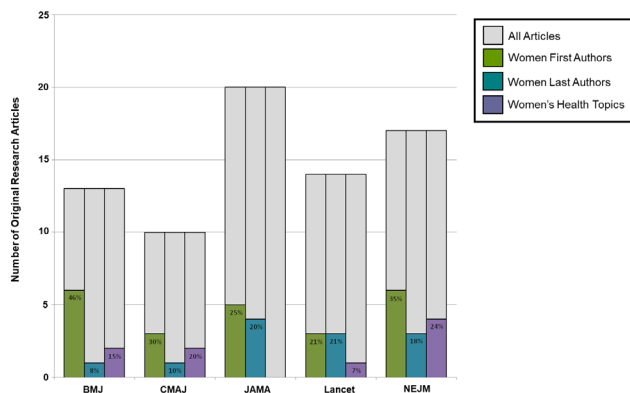
The gender of each article's first/last author was obtained by reviewing author-controlled websites (usually faculty profile pages) for statements of gender or pronoun use. When unavailable, gender was assessed by gender expression(s) in faculty profiles, photographs, and author-controlled social media/research websites (faculty pages, ResearchGate, LinkedIn, etc) and typical gender-associated first names. For 11 authors (15%) the recorded gender was only related to first names. Five of these authors were coded as women and six were coded as men; the probability of error was higher for these decisions.

### Patient and public involvement statement

Patients or the public were not involved in the design, conduct, reporting or dissemination plans for this publication-related research.

## RESULTS

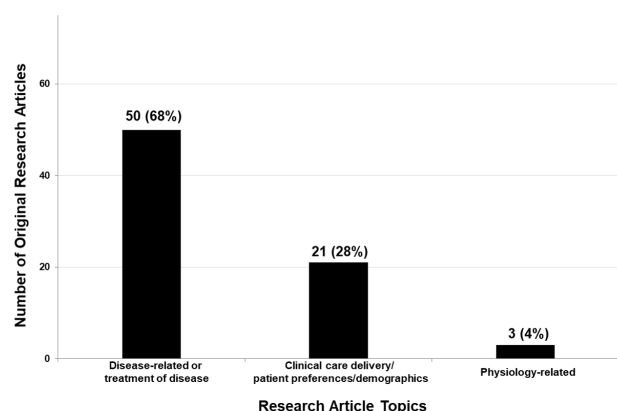
The process of selecting clinical research articles from the two published issues following focal manuscript rejection is shown in figure 1. The ten issues from five major general medical journals produced 74 original research articles for review.



**Figure 2** This bar graph depicts women as a percentage of first (green) and senior/final (blue) authors in clinical research publications and the topics (purple) in proportion of relevance to women's health in two issues each from five major general medical journals.

Figure 2 shows data on the percentage of the sex/gender of the first and senior authors and of women's health-relevant topics. Overall, women were more likely to be first (31% (range 21–46)) rather than senior authors (16% (range 8–21)). Three quarters (73%) of all published research related to health topics relevant to both women and men. No clinical research in these 10 issues covered topics/diseases solely related to men. More men than women were participants in the majority of studies that enrolled both men and women.

Using thematic analysis of all 74 research publications in these issues, we found that some aspect of women's health was the overall focus of 12% of all clinical research (figure 2). Pregnancy-related conditions (as in Zika virus, congenital defects), and breast cancer made up the majority of women's health-related topics. Paediatric health topics comprised 9.5% of studies. In broader content analysis without regard to sex/gender (figure 3),



**Figure 3** This bar graph illustrates the thematic analysis of research article topics (without regard to sex/gender) in the number of papers from a total of 74 tabulated in two issues each from five major general medical journals—the percentage of all papers on a given topic is shown in parentheses.

the majority of publications focused on diseases or their treatment (50 of 74, 68%) and very few were relevant to normal physiology. Of this research on normal physiology, none related specifically to women or women's reproduction.

Sources of funding for these clinical research publications included research grants (74%), support by not-for-profit entities (24%) and by for-profit entities (often pharmaceutical) (15%). The *NEJM* published half of all research publications funded by for-profit entities.

The editorial rejection emails for each of the two submissions were signed by individuals who included their editorial board positions (online supplemental tables 1 and 2). As shown in table 1, in the order in which they were received, are the journal, the journal's impact factor, the date of the decision, the gender of the current editor-in-chief at each decision, and the gender of the person writing the decision letter (F for woman and M for man) and their position. Eight of ten rejection emails were by women with various, usually lower ranked roles from 'Medical Editorial Fellow' to Deputy Editor, Associate Editor, Executive Editor or Senior Executive Editor. None were identified as rejected by the Editor-in-Chief. Seven of ten editorial rejections were during periods of time when men held appointed Editor-in-Chief positions at these high-impact medical journals. Only one of the ten rejection letters included any review; the *NEJM* letter for focal paper #2 included two short reviews, returned within a week of receipt and were thus likely not by peer reviewers.

## DISCUSSION

This research suggests there is author gender and thematic focus bias in general medical journal editorial desk decisions without peer review of two focal papers on unique, women's health physiology revealing, population-based studies.<sup>26 27</sup> Editorial desk rejection is a *previously undescribed barrier for women scientist-researchers*. Men were the majority of first (69%) and final (84%) authors in time-specific published clinical research. Disparity in women's authorship has documented negative implications for career advancement for women researchers,<sup>5–12</sup> for scientific diversity, for the presence of sex/gender disaggregated analysis in published research<sup>22</sup> and for research dissemination.<sup>19 20 28 29</sup> Negative implications logically extend to deficits in the clinical care women patients receive.

Although reviewed articles included some women's health topics, the overwhelming majority of these publications related to diseases or to drugs used to treat them as is reflected in the overall women's health topic publication rates from Medline OVID. Ideally a more finely tuned analysis of publication topics (*not possible here*), would compare the prevalence of a *topic in scientific literature* with its *population-based disease prevalence*. For-profit/pharmaceutical industries support research that increases sales of new medications and thus result in financial gain;

**Table 1** Chronological order of major medical journal rejections, journal impact factors, gender and position of editors for two clinical research focal papers

	Journal	Journal impact factor	Date of rejection/ acceptance	Gender of editor-in-chief	Gender of editorial member who wrote rejection letter	Editorial member job position
Focal paper #1	JAMA rejection	56.272	January 2014	M	F	Associate Editor
	NEJM rejection	91.245	March 2014	M	F	Deputy Editor
	Lancet rejection	79.321	May 2014	M	F	Senior Executive Editor
	BMJ rejection	39.890	June 2014	F	M	Not available*
	CMAJ rejection	8.300	December 2014	M	F	Medical Editorial Fellow
	PLoS One acceptance	3.240	August 2015			Peer reviewed
Focal paper #2	JAMA rejection	56.272	September 2016	M	F	Deputy Editor
	BMJ rejection	39.890	October 2016	F	M	Associate Editor
	Lancet rejection	79.321	November 2016	M	F	Executive Editor
	NEJM rejection†	91.245	December 2016	M	F	Deputy Editor
	CMAJ rejection	8.300	May 2017	F	F	Associate Editor
	JMNI ( <i>Journal of Musculoskeletal and Neuronal Interactions</i> ) acceptance	2.041	July 2017			Peer reviewed

\*But not the Editor-in-Chief on that date.

†Included two short reviews within 7 days.

these may ‘crowd out’ manuscripts of relevance to public health and women’s physiology, as well as work on diseases with lower population frequency whose treatments would not lead to big sales.

The major limitation of this work is that we *do not know*, because we **cannot know** what percent of submitted manuscripts on men’s reproductive physiology topics, written by men first/senior authors, were rejected by the editors without peer review. This analysis is also limited by its sample size (n=74 articles); its results, however, are consistent with other cited studies. Although it might be considered a limitation that the senior author of this paper is also the senior author on one and the first author on the other of the rejected focal papers, we believe it increases transparency. In addition, hers is a hard-to-avoid bias since she designed this analysis and engaged the librarian and editor as coauthors.

As table 1 shows (from online supplemental tables 1 and 2) the majority of rejecting editors were women; all of these appeared to be of junior or even trainee status. It is understood that, while these junior editors wrote the rejection letters, final decisions regarding peer review and publication are made by senior editors who are usually men. It is not uncommon for women, especially in subordinate positions, to adopt dominant cultural/work-place biases. Table 1 shows that majority of the editor-in-chiefs during this analysis time-frame were men who held this position for extended periods of time. Ellinas *et al* compared author sex/gender to the gender representation on The Council of Faculty and Academic

Societies-associated journal editorial boards. Their findings showed that the number of women who were editors was significantly less than the proportion of women in US medical school faculties/scientific positions and that women were more likely to be associate editors and less likely to be section editors and editors-in-chief.<sup>30</sup>

The sex/gender of editors is likely to influence women’s publication. In their 2007 report, ‘Beyond Bias and Barriers’, the Institute of Medicine *et al* called for ‘reasonable representation of women on editorial boards’ and taking ‘steps to minimize gender bias, such as blinded reviews’.<sup>5</sup> Surprisingly, from 2009 to 2014, four high-ranked medical journals had women editors-in-chief and higher rates of women first authors (45% *Annals of Internal Medicine*, 44% *JAMA*, 42% *Archives of Internal Medicine* and 36% *BMJ*).<sup>14</sup> In her editorial and analysis of Filardo’s original research, Rexrode suggested the genders of the editors-in-chief and other editorial board members may influence the topics which are given priority at a given time at a given journal.<sup>31</sup> Promotion of women to editors-in-chief roles is reliant on their academic professional status, which, in turn, is determined by their academic success including publications, grants and the diffusion of their research result in the public/media. In 2019, 79% of the editorial board members at *The Lancet* group of journals were women, including 57% of the editors-in-chief.<sup>32</sup> That women editors are open to women authors or women’s health or reproductive physiology topics, however, is neither guaranteed nor predictable, although

the previously mentioned *Nature* analysis found that more women editors resulted in more women being chosen as reviewers.<sup>18</sup>

Gender biases may relate to women's difficulties in publication since Moss-Racusin *et al* showed that both women and men have consistent, *often unconscious*, gender biases.<sup>13</sup> Raymond, used Harvard's Implicit Association Test website (<https://implicit.harvard.edu/implicit/>) results to support her premise that even experienced *women* researchers harbour gender biases.<sup>33</sup> Similar assessments of bias in publication have focused on editorial board *composition* or on the gender of *reviewers*. Kaatz *et al* discuss the unconscious gender bias unrelated to scientific merit that could create unintentional inequalities and alter scientific peer review.<sup>34</sup>

It is a limitation that we do not know the reasons for editorial rejection. Editors are not required to, nor do they routinely, provide rejection rationales nor reasons. Common focal paper rejection responses, however, did sometimes include that they were more relevant for a *specialist* journal, were not novel, or were not relevant for general practitioners (online supplemental tables 1 and 2). Such comments suggest lingering beliefs in a generic, masculine patient and that women patients' physiology and health concerns are only of relevance to women's health journals or OB/GYN practitioners.

These editorial rejections lead to increased scientific work for authors. However, there is no current tabulation of the time required to revise, resubmit and await responses from major medical journals. One author of one of the focal articles reported nearly being rejected for tenure because a unique manuscript, reporting randomised controlled trial results that were both novel and of practical impact, was rejected six times over 3 years.<sup>35</sup> Kim *et al* discuss how women who research women's health topics are doubly disadvantaged by their own gender and by their machine-learning documented gender-associated research.<sup>23</sup> Thus, threats to career progress/promotion from publishing delays, and low women's health research representation in publication, have fundamental implications for equity in medicine and science. Women's health-focussed researchers commonly report repeated manuscript rejections. For example, in a career progression study of menstrual cycle-focussed researchers, participants reported frequent 'menstrual taboo'-related negative reviews/rejections with 31% of survey respondents reporting some or great difficulty publishing menstrual cycle-related research.<sup>36</sup>

There may also be the important combination of gender bias and publication biases related to research topics. A recent *BMJ* article by Gayet-Ageron *et al* analysed women's authorship position during the COVID-19 pandemic in relation to COVID-19-specific research.<sup>24</sup> While another group had also documented disparities in women authorship for COVID-19 research,<sup>37</sup> the analysis of Gayet-Ageron *et al* specifically found that research about or related to COVID-19 topics resulted in women not holding prominent first and last/senior author positions more often

at the beginning of the pandemic compared with during the pre-pandemic.<sup>24</sup> While it is known that women took on more responsibilities in the early stages of the pandemic (ie, childcare/caretaking, homeschooling, household demands) these reported discrepancies further exacerbate the gender biases and inequalities women face in publication of original research.

Despite significant differences in how women and men experience diseases and drug effects, most research and funding has focused on topics and medications that are more relevant to men.<sup>38 39</sup> These issue-related gender disparities are further amplified when analysing funded diseases relative to population disease-specific burden. Findings suggest that man-focused research/diseases funded by the National Institutes of Health (NIH) between 2015 and 2019 were highly favoured and disproportionately funded in comparison to woman-focused health research/diseases.<sup>40</sup> The COVID-19 pandemic documentation that men's mortality rates exceed women's shows the importance of sex/gender in clinical research.<sup>41</sup> Scientific societies support inclusion of all genders in research, the need to study pregnant women, and the necessity for sex/gender disaggregated analyses.<sup>25</sup> New USA-NIH policies even encourage equal sex distribution in *preclinical* studies and in all designs.<sup>42</sup> Despite these repeated admonitions, 'trials related to HIV, hypertension, and acute coronary syndrome had lower female enrollment in comparison with the prevalence of those disease states in women'.<sup>43</sup> Werbinski recently declared that disaggregating results by sex were as important as including women participants.<sup>44</sup>

Authors of rejected manuscripts on women's physiology and reproductive research topics ended up publishing in lower impact or women's health-focused journals with lower readerships, IF and disseminations. These findings would then suggest that citations in these lower impact journals would be fewer; by contrast, publications in high-impact journals would generate more citations. However, this was not observed, especially for women authors. A 2021 study by Chatterjee *et al* reported that women who had prominent authorship positions were cited less often than men authors in high-impact journals.<sup>45</sup> Additionally, in health topic focused research, articles by research groups with a higher proportion of women coauthors are cited less regardless of the impact factor of the journal and in comparison to discipline-normalised citation rates.<sup>46</sup> Number of citations, overall publications and period of time since publication contribute to a researcher's H-Index. Not surprisingly, women were found to have lower H-Indexes compared with men across most medical specialties and academic ranks, thereby further delaying their career advancement and academic achievement.<sup>47</sup>

Literature suggests that women could improve publication success by including positive words such as 'novel', 'unique' and 'promising' in their manuscripts; although even when using these words, women authors still had less high-impact publication success than men first/last authors.<sup>29</sup> Also, although an increase of positive word

choice to describe the focal papers may have made it more likely to achieve peer review, that would have been unlikely to change: (1) the biases on author-gender and women-health focused topics and/or (2) the prevalence of editorial bias/censorship. A recent online randomised controlled experiment found peer reviewers were more likely to recommend publication of research conducted with men as their subjects vs the same in women, despite the research results having a higher impact for women.<sup>48</sup> An analysis by Macaluso *et al* of higher-impact PLOS journals revealed that there are gender gaps in the roles of scientific authors. Women coauthors were more likely to perform the experiments while men were more likely to contribute to the conceptualisation and writing of manuscripts, especially on publications with men as the first/last authors.<sup>49</sup> Women researchers are more likely to do research with women,<sup>22 50</sup> and there was a higher chance of having a woman first author if the final author was also a woman,<sup>24</sup> despite the likelihood their research would be cited less if there was a higher proportion of women authors.<sup>46</sup> These findings further explain the gender differences in publication rates, especially in high-impact journals and emphasise negative implications for women in career advancement.

There is increasing evidence that diversity improves both productivity and impactful research.<sup>51</sup> For these reasons we suggest that each general medical journal editorial board hire a **'sex/gender champion' editor** with sensitivity to bias issues who is integrated into the journal's leadership structure and reviews all scientific articles for relevance to women's health. The champions would be qualified editors but with expertise and informed sensitivity to issues of bias. Their positions and perspectives on editorial boards would positively influence the diversity of what and who is published and evaluate the implicit biases that exist against particular research. In this recommendation, we draw on the Canadian Institutes of Health Research's Sex and Gender Champions as a model.<sup>52</sup> Ideally editorial boards should also gather and collate data on the gender of authors and relevant topics to ensure gender-related accountability and equity. The gathering of this particular data is also echoed by the Pinho-Gomes team.<sup>37</sup> Although editors recently interviewed felt 'gender-blindness' ensured **lack of bias**, the opposite is likely true.<sup>28 53</sup> Editors have the power to choose diversity or exclusivity in publication, yet in 2012, the European Association of Science Editors' survey of 100 journal editors found 75% were not willing to include sex and gender analysis as a requirement in their journals.<sup>25</sup>

Although research design and manuscript writing now have Sex and Gender Equity in Research (SAGER) guidelines,<sup>25</sup> similar educational strategies and training are needed for editorial sex and gender equity and diversity in peer review and publication. We agree with Rouan *et al* that diversity, equity and inclusion training should be a mandatory requirement for all journal editorial members and peer reviewers and that such training be renewed regularly.<sup>51</sup> Editorial decisions are influenced by an

editor's academic training, professional knowledge and personal experience.<sup>28</sup> For researchers who routinely, and without compensation, peer review many submissions annually, *editorial* rejection without review adds to the feeling that bias is likely involved.

To further decrease probable medical publication sex/gender biases, we also recommend a special **adjudication committee** to review editorial desk rejections on the basis of gender, race or other social disadvantages. A special adjudication committee would help to ensure that there is an open and transparent process for challenging editorial decisions. In addition, this committee would be responsible for implementing regulations and outcomes from equity, diversity and implicit bias training.

Our third recommendation is to assess and achieve gender parity in **peer review**. That means that over 1 year, 50% of reviewed articles would be reviewed by women. Steinberg exemplified the current imbalance by using an algorithm to visualise the need for gender parity in peer review.<sup>54</sup> We support the Lundine *et al* suggestion that journals set diversity goals when selecting editorial board members and peer reviewers and be held accountable for meeting those goals.<sup>53</sup> *The Lancet* group of journals promised plans to achieve gender parity on their editorial advisory boards by the end of 2019.<sup>32</sup> The move towards more women on journal editorial boards, may translate into more requests for women peer reviewers as previously discussed. With gender equity being a current hot topic at all stages of the publication process, gender parity in peer review should now be more attainable. Double-blind review, although not included in the above recommendations since it has been advocated elsewhere,<sup>55</sup> reduces bias due to gender, race, native language and assumptions related to affiliated institutions or countries; it is more likely to focus decisions on research merit and the potential impact on healthcare.

In summary, following the editorial board rejection of two population-based studies of physiological relevance to women, this research has found evidence of gender bias related to authorship, publication topic and that the editor writing the rejection notification tended to be a junior woman. The medical science publication process must be streamlined and effective, but it must also address bias and invest in constructive change. Without implementing change, there will be loss of women's expertise, creativity, perspective and innovation in research to the detriment of healthcare delivery and health outcomes.

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