

## Original article

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## Authorship contributions

All listed authors qualify for authorship and all who were qualified to be authors are listed as authors. R.W. designed the experimental protocol and collected and analysed the data; J.C.F. and J.I.W. designed the experimental protocol and analysed the data; and R.R. and M.C. analysed the data. All the authors were involved in writing the manuscript and revising it.

## Data sharing statement

The data sets used or analysed for the current study are available upon request at the discretion of the corresponding author.

# Trends in the proportion of women as reviewers, editors, and editorial board members of 15 North American and British medical journals from 2014 to 2019: A retrospective study

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## Abstract

**Background and objective:** There is persistent men-dominated gender disparity in medical academia. Predominance of men in the editorial makeup of medical journals might contribute to this inequity. This retrospective study (2014–2019) sought to evaluate gender representation in reviewers, editors, and members of the editorial boards in 15 leading medical journals from the United States, Canada, and the United Kingdom.

**Methods:** We surveyed lists of reviewers, editors, and editorial board members from seven journals of internal medicine, a specialty dominated by men; three journals of obstetrics and gynaecology and two of paediatrics, specialties dominated by women; and three journals of psychiatry, a gender-balanced specialty. Information from publicly available resources was used to infer gender, and the percentages of women were calculated. Trends over time were characterized by changes in these percentages from year to year through the linear regression line fitted to the data for each journal.

**Results:** Journals of women-dominated specialties had significantly higher proportions of women reviewers than those of men-dominated or gender-balanced specialties, with mean percentages (95% confidence interval) of 45.8% (40.5%–51.1%), 28.0% (22.3%–33.7%), and 33.8% (27.6%–40.1%), respectively ( $p < 0.001$ ). The proportion of women editors and editorial board members showed no statistically significant differences across the three specialties, and the percentage of women reviewers, editors, and editorial board members increased only slightly over time.

**Conclusion:** These results suggest that the fifteen journals are yet to achieve gender parity in their reviewers, editors, and editorial board members, and continued efforts are needed to achieve gender balance in those three groups of medical academia.

## Keywords:

Composition of editorial boards, gender bias in medical publishing, medical publishing

## Introduction

Although women now outnumber men in medical schools in the United States,<sup>1</sup> Canada,<sup>2</sup> and the United Kingdom,<sup>3</sup> approximately 67%, 57%, and 52% of practicing physicians in these countries, respectively, are men.<sup>3–5</sup> Gender disparity in North America appears to be narrowing: a survey of 18,000 physicians at 3500 practices in the United States, in 2017, reported that 80% of the physicians 65 years or older were men, whereas 60% of the physicians younger than 35 years were women,<sup>6</sup> and in Canada, between 2015 and 2019, the number of practising physicians that were women increased by 19.2% whereas the number of practicing physicians that were men increased by only 5.8%.<sup>5</sup>

Leadership positions in medicine in the United States, Canada, and the United Kingdom show a persistent gender disparity skewed in favour of men.<sup>7–9</sup> Although the proportion of women in full-time faculty in the United States rose steadily since 2009 and reached 41% in 2019, women make up a majority of faculty only at the rank of an instructor.<sup>7</sup> Among cohorts of assistant professors and associate professors starting in 2008/09, the proportion of men advancing after seven years was greater than that of women, although the gap narrows if examined after 10 years.<sup>7</sup> These numbers strengthen the observation that women comprise only 18% of all department chairs in the United States.<sup>7</sup> Likewise, only 8 women have become deans of Canadian medical schools since 1999,<sup>8</sup> and in the United Kingdom, women comprise only 13% of university-contract clinical professors.<sup>9</sup> Gender disparity among physicians in general extends to some fields of specialization. For example, a 2019 report from the American Medical Association and American Association of Medical Colleges noted that

many medical and surgical specialties are dominated by men.<sup>10</sup> In contrast, the same report noted that 83% of obstetricians-gynaecologists and 72% of paediatricians were women, whereas psychiatry showed the proportions of men and women to be almost equal.<sup>10</sup> The proportions of women in these specialties in Canada and the United Kingdom were similar to those in the United States; less than 40% of internal-medicine physicians, over 60% of obstetricians-gynaecologists, and about half of the psychiatrists were women.<sup>11–14</sup> Therefore, many medical disciplines have yet to achieve gender balance.

Peer-reviewed publications are an important metric for promoting faculty in medical schools, and gender imbalance skewed in favour of men is well documented in senior editorial positions in leading medical journals internationally.<sup>15–17</sup> This gender imbalance may lead to bias that adversely effects the success of women in having their research published, thereby making it even more difficult for women to succeed in academia.<sup>18</sup> Men are twice as likely to be invited to submit articles – a clear marker of success or standing – than women.<sup>19</sup> However, manuscripts authored by women are more likely to be accepted than those authored by men if the authors' names are masked.<sup>20</sup> Consequently, differences in the number of publications and citations between men and women scientists are influenced to varying degrees by gender disparity in peer review or among journal editors and members of editorial boards.<sup>18</sup> To investigate this disparity, we examined changes in the proportions of women serving as peer reviewers, editors, and editorial board members of major medical journals based in the United States, Canada, and the United Kingdom from 2014 to 2019.

## Methods

### *Journal selection*

Fifteen journals were chosen to represent men-dominated, women-dominated, and gender-balanced medical fields (Table 1), namely internal medicine, a field dominated by men; obstetrics and gynaecology, and paediatrics, fields dominated by women; and psychiatry, which is known to show a balanced representation of both men and women. The choice was based on the proportions of active

women physicians in the respective specialties in the United States in 2019, proportions that are known to match those in Canada and the United Kingdom.<sup>11–14,21</sup>

The choice of the journals also considered their Impact Factors for 2019 as an indicator of how frequently the published articles had been cited, and only those journals with high impact factors in the specialty areas were selected for this study.

**Table 1. Fifteen journals selected for the study of gender disparity in their reviewers, editors, and editorial board members.**

Category and perceived domination in reviewers, editors, and editorial board members		
Men-dominated (internal medicine)	Women-dominated (obstetrics and gynaecology, paediatrics)	Gender-balanced (psychiatry)
<i>New England Journal of Medicine</i>	<i>Ultrasound in Obstetrics and Gynecology</i>	<i>American Journal of Psychiatry</i>
<i>Annals of Internal Medicine</i>	<i>British Journal of Obstetrics and Gynaecology</i>	<i>JAMA Psychiatry</i>
<i>British Medical Journal</i>	<i>Journal of Obstetrics and Gynaecology Canada</i>	<i>Lancet Psychiatry</i>
<i>Lancet</i>	<i>JAMA Pediatrics</i>	
<i>Canadian Medical Association Journal</i>	<i>Pediatrics</i>	
<i>Journal of the American Medical Association</i>		
<i>JAMA Internal Medicine</i>		

Journals were separated into men-dominated, women-dominated, and gender-balanced categories based on the proportions of active women physicians in their respective specialties in the United States in 2019

We ascertained whether, during 2014–2019, the proportions of women reviewers, editors, and editorial board members in these journals had increased and the extent of such increase, if any. We also compared changes in these proportions among the three journal categories: men-dominated, women-dominated, and gender-balanced.

### *Determining gender*

A gender was assigned by the first author, following a step-by-step process, to each of the peer reviewers, editors, and

editorial board members without using any software programs. If the journals provided information about the proportion of women reviewers, editors, or editorial board members, these data were used. If such information was unavailable, lists of reviewers, published annually, from 2014 to 2019 were collected from journals' websites. The names of editors and editorial and advisory board members were obtained from the December issue of each journal. Journals were contacted if the required information was not available in the online or print version of the December issues.

Only those editors assumed to be involved in the peer review process were considered. These included editors-in-chief, deputy editors, executive editors, scientific editors, senior editors, and associate editors. In each case, whenever a name was commonly and uniquely associated with one gender, it was assigned to that gender. If the names were gender-neutral or uncommon, descriptions and photographs from university websites, Google Scholar, ResearchGate, ORCID, LinkedIn, and other publicly available resources were used to infer the gender. The information was then used to calculate the proportion of women as a percentage of the total.

We were unable to source the lists of reviewers for *BMJ* (2018 and 2019), *Can Med Assoc J* (2015–2017), *JAMA Intern Med* (2015), *BJOG* (2015 and 2019), *Pediatrics* (2016 and 2019), and *JAMA Psychiatry* (2015), as well as the editors of *Ann Intern Med* (2018), *BMJ* (2014–2019), and the editorial board members for *Ann Intern Med* (2018), *Am J Psychiatry* (2014–2019) and *BMJ* (2014–2019). We contacted *Ann Intern Med* and *BMJ* two or three times for their lists of editors and editorial board members but received no response.

#### Statistical analysis

Mean percentages of women reviewers, editors, and editorial board members in each of the 6 years were computed among the three journal subject categories. The trend over time in the representation of women was characterized by the slope (change in percentage per year) of the linear regression line fitted to each journal's six-year data. The data were analysed using SAS 9.4 (SAS Institute Inc., Cary, North Carolina, USA). Journal means and trend slopes were compared among journal categories using one-way analysis of variance, which provided a global test of any differences among the

categories. Within each journal category, a supportive t-test was conducted to determine whether the mean slope was statistically different from zero. Such testing provided nominal  $p$  values unadjusted for multiple comparisons.

#### Results

##### *Percentages of women as reviewers, editors, and editorial board members*

Across all 15 journals over the period of 2014–2019, women formed 35.1% of the reviewers, 37.6% of the editors, and 33.4% of the editorial board members. Thus, there is little overall difference in the representation of women in the three editorial categories in the major medical journals analysed.

##### *Peer reviewers*

For each journal, and for each year from 2014 to 2019, the total numbers and percentages of women reviewers were determined and are listed in Supplementary Table 1. The mean values over the 6-year period and the rate of change are listed in Supplementary Table 2. Women formed 28.0% (22.3%–33.7%; 95% CI) of the reviewers for journals in the men-dominated specialties; 45.8% (40.5%–51.1%), in women-dominated specialties; and 33.8% (27.6%–40.1%), in the specialty in which neither gender was dominant (Supplementary Table 2). The overall significance of the difference between categories ( $p < 0.001$ ) was largely due to the higher percentage of women reviewers for journals in the category dominated by women. The mean percentage of women reviewers was similar in the gender-balanced and men-dominated journal categories ( $p = 0.16$ ). During the six year period, the mean percentage (95% CI) of women reviewers increased by 0.9% per year (0.3%–1.4%) in journals in men-dominated specialties ( $p = 0.008$ ), but remained unchanged in journals in women-dominated specialties (+0.1% per year, 95% CI: -0.9% to +1.0%;  $p = 0.86$ ) and in gender-balanced journals (+0.8% per

year, 95% CI:  $-0.8\%$  to  $+2.5\%$ ;  $p = 0.16$ ); the overall  $p$  value for the difference was 0.12 (Supplementary Table 2 and Figure 1A).

### Editors

On average (95% CI), women editors formed 45.1% (26.9%–63.2%) of editors of journals in men-dominated specialties, 29.5% (14.8%–44.2%) of those of journals in women-dominated specialties, and 36.1% (0.0%–100.0%) of those of journals that showed little gender disparity (Supplementary Table 2). The mean proportion of women editors did not increase significantly in any of the three journal categories (Supplementary Table 2), and neither the mean percentage of women editors nor the annual trend differed significantly across journal categories ( $p = 0.37$  and  $p = 0.78$ , respectively). This may reflect differences among journals because some journals showed substantial changes in the proportion of women editors during the study period, whereas in other journals the proportion remained more or less unchanged (Supplementary Table 2). Qualitatively, women-dominated journals were further behind in the participation of women as editors at the start of the study period but gained over time compared with the journals in men-dominated and gender-balanced specialties (Supplementary Table 1 and Figure 1B).

### Editorial board members

The percentages of women serving as editorial board members were similar across journal categories, both for the means and the trends over time. On average (95% CI), women formed 34.2% (13.3%–55.1%) of the total number of editorial board members in journals of specialties dominated by men, 31.3% (14.4%–48.3%) in journals of specialties dominated by women, and 36.4% (36.3%–36.5%) in journals of the speciality in which neither was the dominant gender (overall  $p$  value for the difference was 0.92;

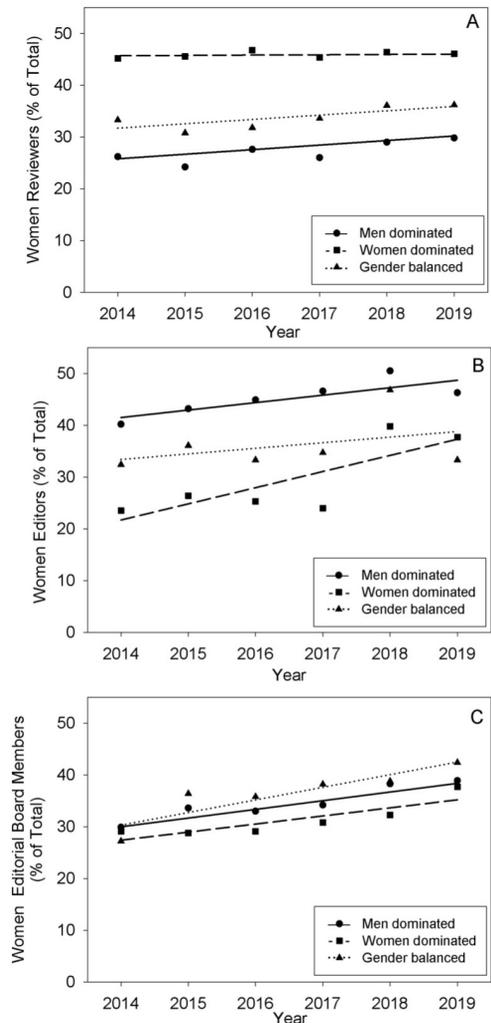


Figure 1. Annual (2014–2019) mean proportion of women reviewers, editors, and editorial board members of American, Canadian, and European journals of medical specialties dominated by men (internal medicine;  $n = 7$ ), by women (obstetrics and gynaecology and paediatrics;  $n = 5$ ), and gender-balanced (psychiatry;  $n = 3$ ) (A) Proportion of women reviewers. (B) Proportion of women editors. (C) Proportion of women editorial board members. Lines represent linear regression of the percent women versus year for each journal category.

Supplementary Table 2). The proportion of women editorial board members increased over time in journals of women-dominated specialties, with an annual mean increase of 1.6% (95% CI: 1.4%–4.5%) whereas the proportion remained unchanged in journals of men-dominated specialties (+1.7% per year; 95% CI:  $-1.2\%$  to  $+4.5\%$ ) as well as in journals of

the gender-balanced specialty (+2.5% per year; 95% CI: -1.1% to +6.0%). The overall  $p$  value for the difference was 0.90 (Supplementary Table 2 and Figure 1C).

### Discussion

Although medical journals are making strides towards gender equity, this study shows that more needs to be done. In the medical journals we evaluated, only about a third of the reviewers, editors, and editorial board members were women. These results are consistent with those from another study.<sup>18</sup> The proportion of women editors and editorial board members did not increase significantly in any of the specialties over a 6-year period, suggesting that gender parity in editors and editorial board members is still a long way off. In contrast, the proportion of women serving as reviewers differed significantly across the specialties and was higher in journals in specialties dominated by women than in journals in specialties dominated by men and in journals in the gender-balanced specialty. Although the proportion of women serving as reviewers in journals of men-dominated specialties increased over time, the overall proportion continued to be lower than that in journals of women-dominated specialties, which remained static over time at less than 50%. Therefore, at least with the journals included in this study, medical publishing is yet to achieve gender parity.

Editors of journals are typically appointed by publishers or by societies that the journals represent. The editors then select the members of the editorial board to ensure that its composition reflects the range of content expertise required and that international journals have appropriate geographical representation. Because editors and editorial board members typically serve

terms of up to five years, changes in gender balance can be slow. Journals with gender imbalance in their editors may also exhibit similar imbalance in their reviewers because reviewers are chosen by journal editors and editors tend to favour reviewers of the same gender as their own.<sup>22</sup> Limited gender diversity in reviewer pools can lead to gender disparities in publication outcomes: one study that examined over 30,000 articles submitted to *eLife* found that manuscripts in which senior authors were men were more likely to be accepted than manuscripts in which senior authors were women when the team of reviewers consisted entirely of men but not when it consisted of men and women.<sup>23</sup> Another study, conducted by the *Journal of General Physiology*, found that the proportion of submitted manuscripts with women senior authors and the overall acceptance rate of submitted manuscripts increased when the journal implemented a policy to include at least one woman reviewer for each manuscript.<sup>23</sup> Overall, these studies suggest that gender diversity among reviewers may decrease gender disparity in the publication process.

The surge in the representation of women in medical schools should facilitate the correction of gender imbalances in medical academia, but the current rate of change suggests that this may take decades.<sup>19</sup> The data for our study were obtained prior to the COVID-19 pandemic. The pandemic may slow the progress being made towards gender equity because at least one study has shown that women submitted fewer manuscripts and accepted peer review invitations less frequently than men did during the first wave of the pandemic.<sup>24</sup> Therefore, more effort should be invested to ensure gender balance among editors and reviewers to encourage gender parity in publishing.

The importance of gender equity in medical academia has become increasingly recognized in recent years.<sup>25</sup> Consequently, several journals examined in our study introduced initiatives to promote gender parity. For example, the *Lancet* group of journals made a public commitment in 2019 to increase the representation of women among editorial advisors, peer reviewers, and authors.<sup>25</sup> These initiatives included a ‘no all-male panel policy’, which forbids its editors from serving as panellists at public conferences if women are not represented on the panel.<sup>25</sup>

Likewise, the *Annals of Internal Medicine* created a set of recommendations to address the challenges that women physicians encounter in private practice and academic medicine.<sup>26</sup> In 2021, the editors of the *JAMA* network introduced several initiatives to promote diversity, equity, and inclusion in the researchers, authors, peer reviewers, editors, and editorial board members of its journals.<sup>27</sup> An important first step in this initiative was publishing diversity data.<sup>28</sup> By measuring and transparently reporting metrics, such as trends in the proportion of women authors, reviewers, editors, and editorial board members, journals can assess whether they are making strides in achieving gender parity in all aspects of peer review and the publishing process. Additionally, such data will inform journals whether efforts to increase gender diversity through policy changes, diversity training, or other initiatives result in gender parity at the level of authors, reviewers, editors, and editorial board members and improvements in the quality of peer review. Therefore, to continue making progress in this area, we recommend that journals consistently collect and publish

diversity data and annual lists of reviewers, editors, and editorial board members: such transparency by journals will likely hasten achievement of gender equity in peer review.<sup>28</sup>

Our study has strengths and weaknesses. Its strengths include the categorization of journals based on the gender composition of the specialties that the journals represent and the analysis of trends over time. Potential weaknesses include the somewhat arbitrary journal selection, short follow-up period, and limited number of journals. Because only high-impact biomedical journals from the United States, Canada, and the United Kingdom were selected, it is uncertain whether the findings are generalizable to lower-impact journals, those from other countries, and journals in other scientific fields. Also, we inferred gender rather than relying on self-report, which could lead to misclassification. Lastly, we captured the percentages of women reviewers but do not know the extent of their engagement or how often they reviewed. If women reviewed more frequently than men, for example, our method would underestimate the impact of women reviewers on the journals.

### Conclusion

The American Medical Association has stated that gender equity is key to achieving excellence in academic medicine.<sup>29</sup> The data from our study suggest that gender parity has not been achieved among the reviewers, editors, and editorial board members of the 15 journals that were analysed. Therefore, continued efforts are required to achieve gender equity in academic medicine.

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