

Gender Disparity in Lead Authorship Before and During the COVID-19 Pandemic: No News Is Bad News?



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INTRODUCTION

Gender inequities in research careers have been documented across clinical and basic sciences.^{1,2} Analyses of preprint databases suggested that women researchers' careers were disproportionately affected by the COVID-19 pandemic.^{3–5} We sought to compare the proportion of research articles published by women relative to men in general medical journals before and during the COVID-19 pandemic.

METHODS

We used PubMed to collect original research articles published by first authors from US institutions in *Annals of Internal Medicine*, *The Journal of the American Medical Association (JAMA)*, *JAMA Internal Medicine*, *The Journal of General Internal Medicine*, *The Lancet*, *Medical Care*, the *New England Journal of Medicine*, and *PLoS Medicine* between March 12, 2019, and June 11, 2021. Articles without an abstract were excluded. Articles were grouped into “pre-COVID” (March 12, 2019, to March 11, 2020) and “during COVID” (June 12, 2020, and June 11, 2021) periods. Articles published between March 12 and June 11, 2020, were excluded to account for the lag time between submission and publication.

To collect gender data, we first reviewed the lead authors' institutional websites for gender pronouns (e.g., he, she, they, ze) (72% of the sample). If not found, we abstracted pronoun data from third-party websites (23%). Last, we searched the U.S. Social Security Database for gender associated with author's first name (5%). We also collected lead authors' graduate degrees and graduation year(s) of the last academic degree from their websites.

The analysis was conducted at the article level. Our outcome of interest was the proportion of articles published in each study month by gender category of lead author. To measure the relative change in publication trends before vs.

during the pandemic, we used linear regression to model the outcome as a function of lead author gender category, an indicator of whether the article was published before or during COVID, an interaction term between these two variables, calendar month, and monthly article volume.

We performed three additional analyses. First, we estimated the model for a subset of articles with first authors with a clinical degree (e.g., RN, NP, MD, DO, MBBS). Second, we stratified by time since lead authors' completion of last academic degree (≤ 10 , 10 to ≤ 20 , and > 20 years). Third, we stratified by journal impact factor (≤ 20 , 21–50, 50+) per the 2020 Journal Citation Reports.⁶

According to the University of Pennsylvania Institutional Review Board, this study using public data did not constitute human subjects research.

RESULTS

Of 2856 articles in the sample, 1312 (45.9%) were published pre-COVID and 1544 (54.1%) during COVID. Men were lead authors on 51.1%, women on 46.1%; the lead authors' gender was not found for 2.8% of articles. The proportion of lead authors who were women was lower among authors with clinical degrees (38.3%), individuals who graduated > 20 years ago (33.8%), and those publishing in higher-impact journals (39.6% for impact factor > 20 and < 50 and 31.5% for ≥ 50) (Table 1). There were no statistically significant differences in the proportion of articles by gender of lead author between the study periods (Fig. 1, Table 1).

DISCUSSION

While the pandemic did not appear to exacerbate gender disparities in lead authorship, baseline disparities persisted with fewer articles published by women compared to men, particularly for higher-impact journals, for authors with clinical degrees, and for those who graduated > 20 years ago.

Our analysis has limitations. We used the date an article was added to the PubMed database as the publication date, which was within 5 days of the earliest publication date (online or in print) for the articles in our sample. Although we excluded articles published in the first three months of the pandemic, some articles published “during COVID” likely represent work submitted before the pandemic. We used pronouns as a proxy for an individual's gender. However, neither pronouns

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Table 1 Research Articles Published Before and During the COVID-19 Pandemic by Lead Author Gender

	Overall, n (%)	Before COVID, n (%)	During COVID, n (%)	% change before vs. during COVID ^a (95% CI)	p-value
All research articles (n=2856)	-	1312 (45.9)	1544 (54.1)	-	-
Men	1458 (51.1)	681 (51.9)	777 (50.3)	Reference	-
Women	1317 (46.1)	598 (45.6)	719 (46.6)	0.9 (-5.3 to 7.1)	0.77
Gender not found	81 (2.8)	33 (2.5)	48 (3.1)	1.3 (-5.0 to 7.5)	0.69
First authors with clinical degrees (n=1662)	-	786 (47.3)	876 (52.7)	-	-
Men	1010 (60.8)	485 (61.7)	525 (59.9)	Reference	-
Women	636 (38.3)	295 (37.5)	341 (38.9)	2.1 (-5.6 to 9.9)	0.59
Gender not found	16 (1.0)	6 (0.8)	10 (1.1)	5.6 (-6.3 to 9.1)	0.72
By time from degree completion (n=2351)	-	1090 (46.4)	1261 (53.6)	-	-
≤10 yrs	1226 (52.1)	588 (53.9)	638 (50.6)	-	-
Men	563 (45.9)	281 (47.8)	282 (44.2)	Reference	-
Women	630 (51.4)	298 (50.7)	332 (52.0)	4.3 (-1.9 to 10.5)	0.17
Gender not found	33 (2.7)	9 (1.5)	24 (3.8)	5.6 (-0.6 to 11.8)	0.08
>10 and ≤20 yrs	568 (24.2)	248 (22.8)	320 (25.4)	-	-
Men	295 (51.9)	127 (51.2)	168 (52.5)	Reference	-
Women	265 (46.7)	118 (47.6)	147 (45.9)	-2.5 (-12.4 to 8.1)	0.68
Gender not found	8 (1.4)	3 (1.2)	5 (1.6)	-1.1 (-11.4 to 9.1)	0.83
>20 yrs	557 (23.7)	254 (23.3)	303 (24.0)	-	-
Men	369 (66.2)	170 (66.9)	199 (65.7)	Reference	-
Women	188 (33.8)	84 (33.1)	104 (34.3)	0.02 (-9.2 to 9.2)	0.99
Gender not found	-	-	-	-	-
By journal impact factor (n=2856)	-	1312 (45.9)	1544 (54.1)	-	-
≤20	1399 (49.0)	649 (46.4)	750 (53.6)	-	-
Men	550 (39.3)	264 (40.7)	286 (38.1)	Reference	-
Women	800 (57.2)	369 (56.9)	431 (57.5)	7.3 (-3.5 to 18.1)	0.18
Gender not found	49 (3.5)	16 (2.5)	33 (4.4)	6.3 (-5.0 to 17.7)	0.18
>20 and <50	717 (25.1)	303 (42.3)	414 (57.7)	-	-
Men	418 (58.3)	174 (57.4)	244 (58.9)	Reference	-
Women	284 (39.6)	120 (39.6)	164 (39.6)	0.2 (-8.2 to 8.6)	0.09
Gender not found	15 (2.1)	9 (3.0)	6 (1.5)	-2.2 (-10.7 to 6.2)	0.06
≥50	740 (25.9)	360 (48.7)	380 (51.4)	-	-
Men	490 (66.2)	243 (67.5)	247 (65.0)	Reference	-
Women	233 (31.5)	109 (30.3)	124 (32.6)	5.0 (-1.9 to 11.9)	0.15
Gender not found	17 (2.3)	8 (2.2)	9 (2.4)	2.9 (-4.0 to 9.7)	0.41

^aLinear regression of monthly publication rate as a function of gender category, study calendar month, whether the month occurred before vs. during COVID, interaction between the first author's gender category and the indicator of whether the month occurred before vs. during COVID, and total article volume per month

nor gender dictate a specific lifestyle, nor are synonymous with a certain relationship role or social position. Finally, clinical degrees may not accurately identify actively practicing clinicians.

Considering the long lag period in the publication process, these findings do not rule out the possibility that the COVID pandemic worsened gender inequities in general medicine research. Nevertheless, our finding of equity in publication

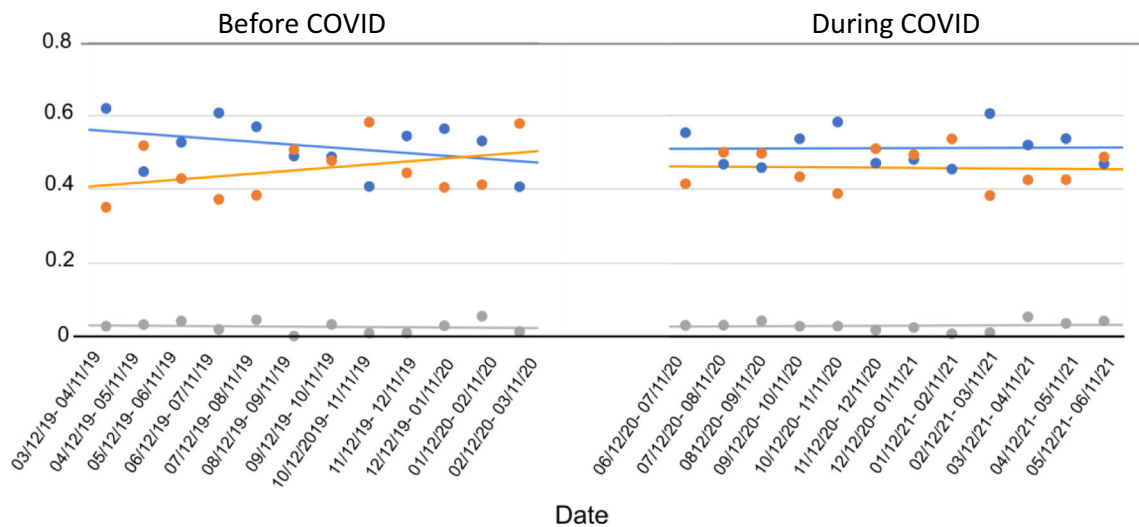


Fig. 1 Research publications by gender of first author before and during the COVID-19 pandemic. Proportion of original research articles published before and during the COVID-19 pandemic by first authors identifying by “he/him/his” (blue), “she/her/hers” (orange), and those articles for which gender pronouns could not be identified (gray). There were no articles in our sample with lead authors in the “they/them/ theirs,” “ze/hir,” or other gender categories. Lines represent linear line of best fit.

rates between men and women lead authors who graduated in the prior decade leaves us hopeful for the future.

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Declarations:

Conflict of Interest: The authors declare that they do not have a conflict of interest.

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