

## Research Letter

# Impact of the Early COVID-19 Pandemic on Gender Participation in Academic Publishing in Radiation Oncology



Nancy Anabaraonye,<sup>a</sup> Chiaojung Jillian Tsai, MD, PhD,<sup>b</sup> Hina Saeed, MD,<sup>c</sup> Fumiko Chino, MD,<sup>d</sup> Ekaete Ekpo,<sup>e</sup> Sudeep Ahuja,<sup>f</sup> Oscar Garcia, MPH,<sup>g</sup> and Robert C. Miller, MD, MBA, FASTRO<sup>h,\*</sup>

<sup>a</sup>University of Pennsylvania, Philadelphia, Pennsylvania; <sup>b</sup>Department of Radiation Oncology, Memorial Sloan Kettering Cancer Center, New York, New York; <sup>c</sup>Department of Radiation Oncology, Medical College of Wisconsin, Milwaukee, Wisconsin; <sup>d</sup>Department of Radiation Oncology, Memorial Sloan Kettering Cancer Center, New York, New York; <sup>e</sup>Johns Hopkins University, Baltimore, Maryland; <sup>f</sup>University of Maryland Baltimore County, Baltimore, Maryland; <sup>g</sup>Division of Neurosurgery, Mayo Clinic Florida, Jacksonville, Florida; <sup>h</sup>Division of Radiation Oncology, University of Tennessee Medical Center, Knoxville, Tennessee

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## Abstract

**Purpose:** There is a known gender gap in oncology publishing with worse disparities within specialty fields such as radiation oncology. There has been a significant increase in the number of articles submitted to academic journals during the pandemic. Several analyses have suggested that the pandemic has had a disproportionate effect on academic productivity of women in academia, as measured by article publication rates.

**Materials and Methods:** The gender of first/co-first and corresponding/co-corresponding authors, as well as nonsenior versus senior status and manuscript type, for all articles published by *Advances* from its inception in December 2015 to the end of February 2020 was compared with those published between March 1, 2020, and May 31, 2020: the months during which the onset of the COVID-19 pandemic in North America began.

**Results:** This examination of papers published during COVID-19 did not indicate a statistically significant decrease in the overall proportion of women publishing in *Advances* ( $P = .76$ ). For nonsenior female authors, this proportion fell just short of statistical significance (39% vs 19%,  $P = .051$ ). When only scientific manuscripts were considered, there was a statistically significant decrease in publications by nonsenior female first authors during the early months of the pandemic (37% vs 11%,  $P = .02$ ).

**Conclusions:** During the early months of the COVID-19 pandemic, nonsenior female researchers participated less in article publishing in radiation oncology.

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The data for this study were collected from articles published in American Society for Radiation Oncology's *Advances in Radiation Oncology* before May 31, 2020 at [www.advancesradonc.org](http://www.advancesradonc.org) and is publicly available on the website.

\*Corresponding author. Robert C. Miller, MD, MBA, FASTRO;  
E-mail: [RCMiller@utmck.edu](mailto:RCMiller@utmck.edu)

## Introduction

There is a known gender gap in academic publishing, including oncology.<sup>1-4</sup> Although the journal submissions, which can affect promotion and academic success, have been on the rise, gender disparities between the rates at which men and women publish continue to be of concern.

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COVID-19 has had a major effect on academic publishing, therefore raising the question of whether this pandemic has negatively affected the number of journal submissions by women and how this may negatively affect their career growth, particularly for nonsenior researchers.<sup>5,6</sup> Accordingly, we performed an analysis to evaluate whether the early months of the COVID-19 pandemic affected publication rates by women in *Advances in Radiation Oncology (Advances)*, the journal primarily responsible for publishing COVID-19 related manuscripts in American Society for Radiation Oncology's family of journals.<sup>7</sup>

## Methods and Materials

We collected information regarding the gender of first/co-first and corresponding/co-corresponding authors for all articles published by *Advances* from its inception in December 2015 to the end of February 2020 and compared them to those published after the early spread of COVID-19 to North America (March through end of May 2020) in a retrospective cross-sectional study. Results were also categorized by comparing scientific manuscripts (defined as scientific articles and research letters) versus nonscientific articles (such as letters to the editors, brief opinions, and review articles) separately for female first authors and corresponding authors. Additionally, manuscript authors were categorized as senior versus junior authors. Senior authors were defined as authors with  $\geq 12$  years' experience since receiving their MD or  $\geq 7$  years since receiving their doctorate if this was their terminal degree. Perceived gender was determined through an Internet search. Additionally, the proportion of authors publishing COVID-19 articles versus non-COVID-19 articles was examined separately. We then compared the results using Fisher's exact test using STATA 14.2 statistical software.

## Results

A total of 458 articles were reviewed, with 392 published before March 1, 2020, and 64 published afterward. Of these 64 articles published during the early COVID-19 period, 56 were COVID-19 related and writing on them only began after March 1, 2020. Thirty-four authors could not have their seniority or gender confirmed and were excluded from the analysis.

Overall, when considering all articles published, there was not a statistically significant difference in the proportion of all manuscripts with female authors (30.3% vs 28.9%,  $P = .75$ ) before and after COVID-19. The difference in proportion of nonsenior female authors before and after the onset of COVID-19 did not reach statistical significance (39% vs 19%,  $P = .051$ ) for all article types

(Table 1). There was also no statistical difference between the proportion of senior female first authors for all types of manuscripts before COVID-19 in comparison to after COVID-19 (29.6% vs. 36.6%,  $P = .33$ ; Table 1). When only scientific articles were considered, there was a statistically significant difference in publication rates by nonsenior female first authors during the early months of the pandemic (37% vs 11%,  $P = .02$ ; Table 1). No other comparisons showed statistically significant differences (Table 1, 2, and 3).

## Discussion

This preliminary examination of papers published during COVID-19 did not identify a statistically significant decrease in the overall proportion of women publishing in *Advances*. The majority of papers submitted during the early pandemic months did not reflect the culmination of long-term projects, but rather, reflected the effect of the stressors of the first lockdown on academic productivity. Some of these articles have become repeatedly cited in a very short interval, with the top *Advances* COVID-19 papers receiving a collective 189 citations in  $<1$  year. Although based on the analysis of a very small number of articles, the data do suggest that nonsenior female authors may not have participated in the boom of publishing that occurred in the early months of the pandemic when the publishing ecosystem was flooded with papers, a finding that has been quantified in other medicine specialties, such as in *JAMA Surgery*, and in scientific disciplines outside of medicine such as astronomy.<sup>8-10</sup> This finding was likely influenced by the number of COVID-19 articles that were quickly written and submitted to *Advances* in the March to May, 2020 period, a trend observed by Ribarovska et al when they found a pronounced decrease in the proportion of women authors in special journal editions devoted to COVID-19 research in mid-2020.<sup>11</sup> Others have also observed a decrease in the proportion of female first authors during the pandemic, such as DeFilippis et al when they examined gender and authorship patterns during COVID-19 in the 4 high effect factor cardiology journals.<sup>12</sup>

Although the overall results of this study were inconclusive, the findings in relation to nonsenior first authors do shed light on the broader problem of gender inequality in academia and warrants a call to identify challenges and opportunities to remediate this issue. A gender gap in academic publishing exists. Family and parental obligations may affect the trajectory of careers differently between women and men. The COVID-19 pandemic, with its restrictions and potential effect on dependent care and other household obligations, may exacerbate the existing gender inequalities in academic productivity.<sup>13</sup> Alternate drivers of inequity could also be, among others, continued implicit bias or even blatant discrimination against

**Table 1** Effect of COVID-19 on publications with female first authors

	Pre-COVID Before March 1, 2020			COVID After March 1, 2020			P value
	Total	Female first author, n (%)	Male first author, n (%)	Total	Female first author, n (%)	Male first author, n (%)	
Non-senior	254	98 (38.6)	156 (61.4)	26	5 (19.2)	21 (80.8)	.051
Senior	160	46 (28.8)	114 (71.3)	38	14 (36.8)	24 (63.2)	.329
Scientific articles							
Non-senior	232	85 (36.6)	147 (63.4)	19	2 (10.5)	17 (89.5)	.021
Senior	152	45 (29.6)	107 (70.4)	25	11 (44.0)	14 (56.0)	.152
Non-Scientific articles							
Non-Senior	22	13 (29.1)	9 (40.9)	7	3 (42.9)	4 (57.1)	.667
Senior	8	1 (12.5)	7 (87.5)	13	3 (23.1)	10 (76.9)	1.000

**Table 2** Effect of COVID-19 on publications with female corresponding authors

	Pre-COVID Before March 1, 2020			COVID After March 1, 2020			P value
	Total	Female corr. author, n (%)	Male corr. author, n (%)	Total	Female corr. author, n (%)	Male corr. author, n (%)	
Non-senior	244	62 (25.4)	182 (74.6)	28	9 (32.1)	19 (67.9)	.442
Senior	147	38 (25.9)	109 (74.1)	36	9 (25.0)	27 (75.0)	.917
Scientific articles							
Non-senior	222	55 (24.8)	167 (75.2)	21	6 (27.3)	15 (71.4)	.701
Senior	139	37 (26.6)	102 (73.4)	21	6 (27.3)	15 (71.4)	.851
Non-science articles							
Non-senior	22	7 (31.8)	15 (68.2)	7	3 (42.9)	4 (57.4)	.665
Senior	8	1 (12.5)	7 (87.5)	15	3 (20.0)	12 (80.0)	1.000

*Abbreviation:* corr. = corresponding.

**Table 3** Effect of COVID-19 on publications with either first or corresponding female authors

	Pre-COVID Before March 1, 2020			COVID After March 1, 2020			P value
	Total	Total female authors, n (%)	Total male author, n (%)	Total	Total female author, n (%)	Total male author, n (%)	
Non-senior	498	160 (32.1%)	338 (67.9%)	54	14 (25.9%)	40 (74.1%)	0.351
Senior	307	84 (27.4%)	223 (72.6%)	74	23 (31.1%)	51 (68.9%)	0.523

women, a relatively higher burden of service obligations versus research work among female faculty, and indirect effects of a lack of women in leadership positions.

**Conclusions**

In summary, the study reported here can help guide our understanding of the effect of gender-based stereotypes on academic success that were already present before the pandemic. Zayed et al previously reported that, in the 10-year period of *International Journal of Radiation*

*Oncology, Biology, Physics and Radiotherapy & Oncology* journal publications between 2007 and 2016, there was an overall increase in the mean percentage of female authors in radiation oncology from 24% to 35%, but there was no significant increase in the proportion of first or senior authors.<sup>14</sup> Additionally, Ahmed et al reported that for the *International Journal of Radiation Oncology, Biology, Physics* publications between 1980 and 2012, there was a significant increase in the percentages of both female first authors (13.4%-29.7%) and female senior authors (3.2%-22.6%).<sup>15</sup> Holliday et al reported that from 1996 to 2012, women in radiation oncology had a lower median number

of publications in comparison to male counterparts in regard to academic position, except assistant professors. Although the methods and findings differ from study to study, they all corroborate the existence of gender disparities in academia.<sup>16</sup> These studies, along with the data presented here, should raise awareness of the persistence of such disparities. Every academic institution should make a firm commitment to promoting gender equity through recruitment of women in academia, peer mentoring, networking, professional development support, and prevention of burnout.

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## References

- Huang J, Gates AJ, Sinatra R. Albert-László Barabási. Historical comparison of gender inequality in scientific careers across countries and disciplines. *Proc Natl Acad Sci U S A*. 2020;117:4609–4616. Accessed June 15, 2021.
- Andersen JP, Nielsen MW, Simone NL, Lewiss RE, Jagsi R. Meta-research: Is COVID-19 amplifying the authorship gender gap in the medical literature? Available at: <https://arxiv.org/abs/2005.06303>. Accessed June 15, 2021.
- Dalal N, Chino F, Williamson H, Beasley G, Salama A, Palta M. Mind the gap: Gendered publication trends in oncology. *Cancer*. 2020;126:2859–2865.
- Yalamanchali A, Zhang ES, Jagsi R. Trends in female authorship in major journals of 3 oncology disciplines, 2002-2018. *JAMA Netw Open*. 2021;4: e212252.
- Viglione G. Are women publishing less during the pandemic? Here's what the data say. *Nature*. 2020;581:365–366.
- Gewin V. The career cost of COVID-19 to female researchers, and how science should respond. *Nature*. 2020;583:867–869.
- Miller RC, Tsai CJ. Scholarly publishing in the wake of COVID-19. *Int J Radiat Oncol Biol Phys*. 2020;108:491–495.
- Nigrovic LE, Napper T. Marked escalation in journal submissions during COVID-19 pandemic. *Ann Emerg Med*. 2020;77:130–131.
- Squazzoni F, Bravo G, Grimaldo F, Garcia-Costa D, Farjam M, Mehmani B. Only second-class tickets for women in the COVID-19 race. A study on manuscript submissions and reviews in 2329 Elsevier journals. *PLoS ONE*. 2021;16: e0257919.
- Inno L, Rotundi A, Piccialli A. COVID-19 lockdown effects on gender inequality. *Nat Astron*. 2020;4:1114.
- Ribarovska AK, Hutchinson MR, Pittman QJ, Pariante C, Spencer SJ. Gender inequality in publishing during the COVID-19 pandemic. *Brain Behav Immun*. 2020;91:1–3.
- DeFilippis EM, Sinnenberg L, Mahmud N, Wood MJ, Hayes SN, Michos ED, Reza N. Gender differences in publication authorship during COVID-19: A bibliometric analysis of high-impact cardiology journals. *J Am Heart Assoc*. 2020;10: e019005.
- Carr PL, Ash AS, Friedman RH, et al. Relation of family responsibilities and gender to the productivity and career satisfaction of medical faculty. *Ann Intern Med*. 1998;129:532–538.
- Zayed S, Qu X, Warner A, Zhang T, Laba J, Rodrigues G, Palma D. Are female radiation oncologists still underrepresented in the published literature? An analysis of authorship trends during the past decade. *Adv Radiat Oncol*. 2019;5:325–332.
- Ahmed AA, Egleston B, Holliday E, Eastwick G, Takita C, Jagsi R. Gender trends in radiation oncology in the United States: A 30-year analysis. *Int J Radiat Oncol Biol Phys*. 2014;88:33–38.
- Holliday EB, Jagsi R, Wilson LD, Choi M, Thomas Jr CR, Fuller CD. Gender differences in publication productivity, academic position, career duration, and funding among US academic radiation oncology faculty. *Acad Med*. 2014;89:767–773.