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Gender Differences in National Institutes of Health Grant Submissions Before and During the COVID-19 Pandemic

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Abstract

Introduction: Emerging data suggest that the COVID-19 pandemic has disproportionately impacted women in academic medicine, potentially eliminating recent gains that have been made toward gender equity. This study examined possible pandemic-related gender disparities in research grant submissions, one of the most important criteria for academic promotion and tenure evaluations.

Methods: Data were collected from two major academic institutions (one private and one public) on the gender and academic rank of faculty principal investigators who submitted new grants to the National Institutes of Health (NIH) during COVID-19 (March 1st, 2020, through August 31, 2020) compared with a matched period in 2019 (March 1st, 2019, through August 31, 2019). *t*-Tests and chi-square analyses compared the gender distribution of individuals who submitted grants during the two periods of examination.

Results: In 2019 (prepandemic), there was no significant difference in the average number of grants submitted by women compared with men faculty. In contrast, women faculty submitted significantly fewer grants in 2020 (during the pandemic) than men. Men were also significantly more likely than women to submit grants in both 2019 and 2020 compared with submitting in 2019 only, suggesting men faculty may have been more likely than their women colleagues to sustain their productivity in grant submissions during the pandemic.

Discussion: Women's loss of extramural funding may compound over time, as it impedes new data collection, research progress, and academic advancement. Efforts to support women's research productivity and career trajectories are urgently needed in the following years of pandemic recovery.

Keywords: gender equity, academia, pandemic, grant submission, COVID-19

Introduction

GENDER DISPARITIES ARE WELL DOCUMENTED in academic medicine, such that women faculty are paid less, receive fewer promotions, and are less represented in senior

faculty ranks compared with men faculty.¹⁻⁴ One commonly proposed explanation for these gender disparities is research productivity, as women in academic medicine tend to publish less and have lower h-indices than men, particularly in the early years of their careers.^{5,6}

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A number of factors may underlie the discrepancy in research productivity, including gendered divisions of household and caregiving responsibilities⁷ and the tendency for women to spend a greater proportion of their professional time in teaching, patient care, and university service activities,⁸ all of which detract from the time available for research activities and are generally not evaluated as highly during tenure and promotion review.^{8,9} Importantly, these individual-level experiences may be affected by systemic and structural issues that contribute to gender disparities in research productivity. For example, compared with their male colleagues, women faculty are more likely to receive nonresearch-related work requests¹⁰ and are less likely to report that the distribution of work within their department is fair.¹¹

From the initial months of the pandemic, concerns were raised regarding the potential for the COVID-19 pandemic to exacerbate gender disparities in academic medicine, at least partly through the disproportionate negative impacts on the time available for research activities relevant for career advancement.¹² Shelter-in-place guidelines necessitated by the pandemic increased homeschooling and caregiving responsibilities, which tend to be shouldered by women.⁷ The pandemic also increased clinical care and university service needs, which, again, tend to be predominantly assumed by women faculty.¹³

Thus, perhaps unsurprisingly, studies conducted after the onset of the pandemic indicated that compared with men, women reported less time spent on work,¹⁴ including less time spent on research¹⁵ and greater negative impacts on research productivity.^{16–18} During the pandemic, women also submitted fewer articles overall¹⁹ and fewer COVID-19–related articles,^{20–22} and less frequently held the first author position.²³

Within academia, the ability to obtain research grant funding is among the most important criteria considered during promotion and tenure evaluations,²⁴ but to our knowledge, no study has examined the potential impact of the pandemic on gender disparities in grant submissions. Given its fundamental influence on career trajectories, we sought to evaluate how the pandemic influenced grant submissions for men and women faculty at two top-tier academic institutions in the United States.

Materials and Methods

We examined the number of new grants (first submissions) by faculty principal investigators (PIs) to the National Institutes of Health (NIH) in a 6-month period during COVID-19 (*i.e.*, March 1st, 2020, through August 31, 2020) compared with a matched prepandemic period in 2019 (*i.e.*, March 1st, 2019, through August 31, 2019). We gathered data from the schools of medicine at the University of California, San Francisco (UCSF), and Stanford University. We received names of PIs who submitted grants from the respective research office at each institution.

PI gender and academic rank (assistant, associate, or full professor) were abstracted from employment records for Stanford faculty and were coded using institutional websites and the website *genderize.io* for UCSF faculty. UCSF institutional websites are written by UCSF faculty members to summarize their educational, clinical, and/or research backgrounds. They typically include individuals' preferred pronouns (*e.g.*, *Dr. X received her BA in biology from X college*

and completed her residency at X university). Thus, the gender for this person would be coded as female using her own self-identified pronouns).

The website *genderize.io* was used to infer gender in the very rare occurrence ($\leq 2\%$) that gender could not be derived from the UCSF institutional profiles. An inferred gender is presented only for cases with $>90\%$ confidence, whereas gender ambiguous names are excluded (although there were no instances of this in this study). This approach has been used frequently in prior studies^{25–27} and a previous examination of *genderize.io* has shown that the proportion of misclassified physicians is low.²⁸ We obtained IRB approval from both institutions.

We first summarized the average number of grants submitted by women and men faculty PIs in the two periods of examination. We then conducted a chi-square test to determine whether the gender distribution of individuals submitting in both periods differed from the distribution of individuals who only submitted during the prepandemic period. Lastly, we constructed a multivariable regression model to determine whether gender was independently associated with the individual-level change in new NIH grant submissions from the 2019 period to the 2020 period. Multivariable models adjusted for gender (with women serving as the reference group), rank (with assistant professors serving as the reference group), and institution (with Stanford University serving as the reference group).

Results

Across both institutions, 481 faculty ($n = 179$, 37% women) submitted at least one new NIH grant in the 6-month period in 2019 compared with 567 faculty ($n = 204$, 36% women) who submitted at least one new NIH grant in the matched 6-month period in 2020 (Table 1). Of note, in 2020–2021, women comprised $\sim 50\%$ of the faculty across institutions who may submit NIH grants. In 2019, there was no significant difference in the average number of grants submitted by women (mean $[M] = 1.24 \pm 0.53$) compared with men faculty ($M = 1.29 \pm 0.71$; $t = -0.90$; $p = 0.405$).

In contrast, women faculty submitted significantly fewer grants in 2020 than men ($M = 1.27 \pm 0.59$ for women faculty vs. $M = 1.45 \pm 0.89$ for men faculty; $t = -2.97$; $p = 0.01$). Men were significantly more likely than women (81% vs. 55%) to submit grants in both the 2019 and 2020 periods compared with submitting in the 2019 period only ($X^2 = 3.864$, $p = 0.049$; Table 2).

Overall, both men and women faculty submitted more grants in the 2020 versus the 2019 period. A multivariable regression model that predicted the individual-level change in the average number of grants from 2019 to 2020 (accounting for gender, rank, and institution) revealed this increase was numerically larger among men than among women; however, this change did not reach statistical significance ($B = 0.17$, 95% CI, -0.02 to 0.35 , $p = 0.078$; Table 3).

There was also a significant main effect of rank whereby associate professors demonstrated a larger increase in grant submissions from prepandemic (in 2019) to during the pandemic (in 2020) than assistant professors ($B = 0.26$, 95% CI, 0.01 – 0.51 , $p = 0.043$). There was no significant difference between assistant professors and full professors in the pre-to-during pandemic change in grant submissions. Gender and academic rank did not interact to predict the change in grant submissions from before the pandemic to during the pandemic.

TABLE 1. NUMBER OF FACULTY WHO SUBMITTED NEW NATIONAL INSTITUTES OF HEALTH GRANTS (*n*) AND AVERAGE NUMBER OF SUBMISSIONS BY GENDER AND RANK IN THE 2019 AND 2020 PERIODS

		Women			Men		
		Faculty n	Grants		Faculty n	Grants	
			Mean	SD		Mean	SD
2019 period	Assistant	65	1.20	0.47	81	1.27	0.65
	Associate	40	1.25	0.63	69	1.22	0.48
	Full	74	1.27	0.53	152	1.34	0.82
	Total	179	1.24	0.53	302	1.29	0.71
2020 period	Assistant	71	1.18	0.39	96	1.24	0.59
	Associate	53	1.30	0.54	78	1.53	0.89
	Full	80	1.32	0.74	189	1.53	0.99
	Total	204	1.27	0.59	363	1.45	0.89

Note. Some faculty may be counted in both categories (because they submitted in both the 2019 period and the 2020 period). SD, standard deviation.

Discussion

Even before the COVID-19 pandemic, women faculty regularly encountered challenges to career advancement in academia. Emerging data indicate the pandemic has increased women's caregiving and academic service responsibilities with concomitant decreases in their productivity; this has led to warnings that without institutional support and resources, a "secondary epidemic of lost early career physicians and scientists" is likely to occur.¹² Although prior research has documented the negative impact of the pandemic on women's available research time¹⁵ and article submissions,¹⁹ this study is the first, to our knowledge, to examine potential pandemic-related gender differences in grant submissions.

In two large academic institutions, we examined new NIH grant submissions from women and men faculty PIs during the COVID-19 pandemic compared with a matched period during the prior year. Results indicated that the average number of new NIH grant submissions was higher for men versus women during the pandemic; however, there was no significant gender difference in submitted grants during the matched prepandemic period in 2019.

Moreover, compared with women, men faculty who submitted grants before the pandemic were significantly more likely to also submit NIH grants during the pandemic. Such findings suggest that the negative impact of the pandemic on research productivity may have been less pronounced for men compared with women in academic medicine.

TABLE 2. PROPORTION OF FACULTY WHO SUBMITTED NEW NATIONAL INSTITUTES OF HEALTH GRANTS IN BOTH THE 2019 AND 2020 PERIODS RELATIVE TO THOSE WHO SUBMITTED IN 2019 ONLY

	Women	Men
Assistant	41%	64%
Associate	73%	79%
Full	60%	90%
Total	55%	81%

There are several potential reasons for this gender disparity in grant submissions. Women may have assumed greater teaching or service responsibilities during the pandemic at the expense of tasks related to research productivity. It has been shown that compared with men faculty, women faculty are more likely to be sought for uncompensated service activities and/or to provide emotional support for colleagues (*i.e.*, "academic housekeeping"⁹ or "secret service"⁸), a pattern that has appeared to persist during the pandemic.¹³ In addition, a large study of women in the United States conducted during the pandemic revealed that mothers were three times more likely than fathers to carry the majority of housework and caregiving responsibilities.²⁹

Although we can only speculate about these potential explanations for our pattern of findings, it is crucial to understand drivers of gender disparities in grant submissions to inform equitable supports and advancement determinations in the following years of pandemic recovery. Illustratively, efforts from one national health research funder to extend grant application deadlines and consider gender in COVID-19 grant requirements resulted in an increase in grants received from and awarded to women scientists.³⁰ Thus, organizational or institutional policies to mitigate potential gender disparities in grant submissions may be beneficial.

Interestingly, the average number of grant submissions increased for all PIs after the onset of the pandemic, consistent with data indicating that NIH received a higher number of R01-equivalent applications after the COVID-19 pandemic onset compared with a matched period in 2019.³¹ Although in this study gender was not associated with the increase in grant submissions during the pandemic, individuals at the associate professor rank in the present sample exhibited a greater increase in submissions than those at the assistant professor rank. Emerging data suggest that junior women faculty may be especially vulnerable to the negative consequences of the pandemic,¹⁹ possibly at least partly due to the fact that those in the early career stage may be likely to have very young children with time-intensive caregiving needs.²³

This study is strengthened by its inclusion of all faculty PIs at two highly ranked academic medical centers, one private

TABLE 3. REGRESSION MODELS PREDICTING THE CHANGE IN NATIONAL INSTITUTES OF HEALTH GRANT SUBMISSIONS FROM 2019 TO 2020 FROM GENDER AND RANK AT UNIVERSITY OF CALIFORNIA, SAN FRANCISCO AND STANFORD

	<i>Coefficient (univariable)</i>	<i>Coefficient (multivariable)</i>
Gender		
Women (reference)	—	—
Men	0.14 (−0.03 to 0.32, $p=0.114$)	0.17 (−0.02 to 0.35, $p=0.078$)
Rank		
Assistant professor (reference)	—	—
Associate professor	0.27 (0.02 to 0.52, $p=0.034$)	0.26 (0.01 to 0.51, $p=0.043$)
Full professor	0.18 (−0.03 to 0.39, $p=0.097$)	0.15 (−0.05 to 0.36, $p=0.147$)
Institution		
Stanford (reference)	—	—
UCSF	0.04 (−0.14 to 0.21, $p=0.671$)	0.04 (−0.14 to 0.22, $p=0.654$)

UCSF, University of California, San Francisco.

and one public, during an unprecedented time with wide-reaching professional and personal consequences. However, there are also several limitations that must be considered. First, this study included only two institutions and data were limited to a narrow timeframe that may not fully reflect the impact of the pandemic on gender disparities. Second, we did not have data on previous research experience, caregiver/parental status, or other intersectional characteristics (*e.g.*, race/ethnicity) that may be associated with grant submissions, all of which will be important contextual variables for future research to include. Third, gender is not binary and is optimally collected by self-report, however, relying upon self-reported gender would limit the study to a nonrandom subset of respondents. Finally, we were unable to examine potential disparities in the gender or academic rank of individuals who successfully received funding after submission of a new NIH grant. Future research with a wider range of institutions across longer timeframes is needed to examine generalizability and to understand the potential long-term effects of the pandemic.

Conclusions

In sum, results of this study suggest that men may have been more likely than their women faculty colleagues to sustain their productivity in grant submissions during the COVID-19 pandemic. Given the cumulative nature of pandemic stressors and their impact on research activities that pave the way for grant submissions (*e.g.*, collection of pilot or preliminary data), it is likely that the pandemic will continue to impede upon women's productivity over the next several years. Given the considerable impact of extramural funding on academic advancement, efforts to support women's research productivity and advancement are urgently needed to prevent loss of the gains we have already made toward gender equity in academic medicine.³²

Authorship Confirmation Statement

All authors made substantial contributions to the conception or design of the study; or the acquisition, analysis, or interpretation of data for the study. All authors were responsible for either drafting the study or revising it critically for important intellectual content. All authors provided final approval of the version to be published. All authors agree to be accountable for all aspects of the study in ensuring that questions related to the accuracy or integrity of any part of the study are appropriately investigated and resolved.

Disclaimer

The contents of this article are solely the responsibility of the authors and do not necessarily represent the official views of the NIH.

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