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Gender Composition in Biomedical Research Grant Submissions and Grant Review Panels Before Versus During the COVID-19 Pandemic

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Abstract

Purpose: This study examined the gender composition of career development award applicants and grant review panels during the pandemic compared with that beforehand.
Methods: Data were collected from 14 Health Research Alliance (HRA) organizations, which fund biomedical research and training. HRA members provided the gender of grant applicants and grant reviewers during the pandemic (April 1, 2020, to February 28, 2021) and prepandemic (April 1, 2019, to February 29, 2020). The signed-rank test compared medians and the chi square test compared the overall gender distribution.
Results: The total number of applicants was similar during the pandemic ($N = 3{,}724$) and prepandemic ($N = 3{,}882$) periods, as was the percentage of women applicants (45.2% pandemic vs. 44.9% prepandemic, $p = 0.78$). The total number of men and women grant reviewers declined during the pandemic ($N = 856$) compared with that pre-pandemic ($N = 1{,}689$); this decrease was driven by a change for the largest funder. Also driven by changes for this one funder, the percentage of total grant reviewers who were women increased significantly during the pandemic (45.9%) compared with that during prepandemic (38.8%; $p = 0.001$), but the median percentage of women grant reviewers across organizations remained similar during the pandemic (43.6%) and prepandemic periods (38.2%; $p = 0.53$).
Conclusions: In a sample of research organizations, the gender composition of grant applicants and grant review panels remained similar, except for the review panel composition for one large funder. Given evidence from other studies that have revealed gender differences in other career and life experiences of scientists during the pandemic, ongoing evaluation of women's representation in grant submission and review mechanisms is essential.

Keywords: COVID-19, gender, grant submissions, grant review panels

Introduction

COVID-19 has dramatically impacted the careers of faculty in academic medicine. Health and safety measures that were enacted to reduce the spread of COVID-19 led to school closures and disruptions in childcare, increasing domestic care responsibilities that tend to be predominantly shouldered by women.[1–5] Recent data suggest that women have disproportionately assumed the additional childcare responsibilities that emerged in the context of the COVID-19

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pandemic.[3] Service needs for clinical care and education in the workplace also increased, which again may disproportionately affect women.[6] Emerging empirical research has documented the pronounced negative consequences of the pandemic on women in medicine and science compared with their male colleagues, particularly on scholarly and productivity indices that bear considerably on future career advancement.[5]

For example, women submitted fewer peer-reviewed articles,[7] were less represented in the first author position[8] or senior author position[9] in journal submissions, and reported spending more time as primary caregiver[10] during the pandemic. A survey of faculty indicated that women were significantly more likely to report a negative impact of the pandemic on productivity than their male colleagues.[11] Women also submitted fewer registered reports during the pandemic[12] and reported significantly fewer available working hours.[13] Surveys of principal investigators also indicate a decline in the rate of initiating new research projects, particularly women and those with young children.[14]

In a sample of >45,000 researchers who received extramural funding from National Institutes of Health (NIH), among men and women providing care for children under age 5, women were more likely than men (66% vs. 56%) to report substantial difficulty completing work responsibilities due to caretaking responsibilities. Among women surveyed, the most important predictors of a negative anticipated career trajectory were the impact of the pandemic on research-related activities and the ability to apply for grants.[15] Pandemic-related stressors forced many women researchers to take leave to provide childcare[16] or leave their academic positions, prompting concerns of an ''epidemic of loss'' of women in the sciences.[17]

Therefore, there is reason to worry about whether scientists can maintain their professional contributions, particularly those who are experiencing the effects of pandemic-related disruptions most acutely, such as early career women who are caring for younger children, reassigned to pressing service needs, and actively involved in pilot data collection and grant writing to build their research programs.[18,19] A disproportionate decline of women researchers has profound implications across all areas of science, perhaps most significantly in slowing progress in sex and gender-related research that is more likely to be led by women.

Career development or training grants are key mechanisms through which junior scholars obtain funding for pilot data collection, participate in essential training experiences, and receive mentorship that prepares them for careers as independent investigators.[20] Thus, not being able to apply for and secure training grants may substantially impact the career trajectories of individuals in academic medicine. In this study, we examined whether there were differences in the number or gender composition of career development/training grant applications during the first phase of the pandemic as compared with those before the pandemic.

We also explored potential differences in the gender of individuals serving on grant review panels during the pandemic compared with a matched prepandemic period, given concerns that women in more senior positions might also disproportionately be facing pressures that compromise their ability to participate in such activities.[21]

Methods

We surveyed all 99 members of the Health Research Alliance (HRA), an organization of funders of biomedical research and training. The HRA member organizations span a range of types of nongovernmental funders of projects to improve human health, including voluntary health agencies, private foundations, and operating foundations. We elected to survey the HRA because of its substantial role in funding health research (over $21 billion to date, with annual awards of ~$1.5 billion) and because it offered an important complement to extant studies of pandemic-related gender disparities in other scholarly activities (*e.g.*, submission of peer-reviewed articles) and data reported by government funders.

Aggregate data were collected from respondent organizations on the gender of applicants to career development awards that were due during the pandemic (April 1, 2020, through February 28, 2021) and those that were due during the same calendar months prepandemic (April 1, 2019, through February 29, 2020). Career development awards were defined as grants offered to postdoctoral fellows or early career faculty who were within 10 years of completion of their MD, PhD, or other terminal doctorate.

HRA organizations also provided aggregate data on the gender composition of virtual and in-person grant review committees during the two aforementioned 10-month periods in 2019–2020 and 2020–2021. The survey was open for responses during a 3-month period. We relied on each organization to ensure that the data submitted were accurate. Please see Supplementary Material for a copy of the survey distributed to the HRA.

Anderson–Darling two-sample tests (AD) evaluated for differences in funding amounts and grants awarded between responding organizations and non-responding organizations within the HRA. The signed-rank test compared the median number of applicants and grant reviewers per organization before the pandemic with those during the pandemic. The chi square test compared the overall gender distribution of applicants and grant reviewers before the pandemic with those during the pandemic. The research plan was filed with the University of Michigan Institutional Review Board (IRB), which did not consider it to require regulation because no identifiable private information was included about the subjects of the research.

Results

Of 14 responding organizations (14% of the 99 surveyed), 13 reported on the gender of career development award applicants and 12 reported on the gender of grant review panel members. Respondent organizations did not differ from nonrespondent organizations in terms of funding amounts ($AD = 2.5$, $p = 0.93$) or the number of grants awarded ($AD = 2.5$, $p = 0.12$). The total number of applicants was similar during the prepandemic ($N = 3,882$) and pandemic ($N = 3,724$) periods (median 55 [interquartile range; IQR 30–308] vs. 72 [IQR 16–303], $p = 0.89$).

During the pandemic, the median number of women applicants per organization was 17 (IQR 12–154), as compared with 37 [IQR 6–130] prepandemic; this difference was not statistically significant ($p = 0.89$). The percentage of total applications submitted by women during the pandemic (45.2%) was also not significantly different than the percentage of total applications submitted by women (44.9%) before the

Table 1. Percentage and Number of Women and Men Career Development Award Applicants for Each Organization Before (Year 1) and During the Pandemic (Year 2)

	Year 1			*Year 2*		
Organization	*Total* n	*Women: % (*n*)*	*Men: % (*n*)*	*Total* n	*Women: % (*n*)*	*Men: % (*n*)*
A	2	0 (0)	100 (2)	3	100 (3)	0 (0)
B	15	13 (2)	87 (13)	15	13 (2)	87 (13)
C	16	38 (6)	62 (10)	17	36 (6)	65 (11)
D	16	38 (6)	62 (10)	30	40 (12)	60 (18)
E	15	47 (7)	53 (8)	31	48 (15)	52 (16)
F	29	48 (14)	52 (15)	32	53 (17)	47 (15)
G	72	56 (40)	44 (32)	60	60 (36)	40 (24)
I	108	34 (37)	66 (71)	55	24 (13)	76 (42)
J	260	47 (122)	53 (138)	308	50 (154)	50 (154)
K	303	45 (136)	55 (167)	280	44 (123)	56 (157)
L	358	36 (130)	64 (228)	383	42 (160)	58 (223)
M	474	35 (168)	65 (306)	450	37 (165)	63 (285)
N	2,214	49 (1,074)	51 (1,140)	2,060	47 (977)	53 (1,083)
Overall totals	3,882	45 (1,742)	55 (2,140)	3,724	45 (1,683)	55 (2,041)

pandemic ($p=0.78$), nor was the median percentage of applications submitted by women across the organizations (43.9% [IQR 35.4–46.9] vs. 37.5% [IQR 36.7–50], $p=0.14$). Table 1 and Figure 1 displays the number of men and women career development award applicants for each organization before and during the pandemic.

The total number of grant reviewers was lower during the pandemic ($N=856$) than before the pandemic ($N=1,689$), driven by a change in the number of reviewers for the largest funder (organization *N*, Fig. 2). When the largest funder was not included, there were $N=315$ grant reviewers during the pandemic and $N=324$ grant reviewers before the pandemic. The median number of reviewers across all organizations was similar between the two time periods (21 [IQR 7–39] vs. 23 [IQR 0–47], $p=0.57$). There was also no difference in the median number of women grant reviewers per organization during the pandemic (median 13, [IQR 2–16.5]) compared with that before the pandemic (median 14.5, [IQR 1–20], $p=0.82$).

The percentage of grant reviewers during the pandemic who were women (45.9%) was significantly higher than the percentage of grant reviewers before the pandemic who were women (38.8%; $p=0.001$), but the median percentage of women among reviewers across organizations remained similar during the pandemic (43.6% [IQR 30–48.1]) versus before the pandemic 38.2% ([IQR 29.2–50.0]; $p=0.53$). The increase in the overall percentage of reviewers who were women appeared to be driven by the largest responding organization (organization *N*, Fig. 2), which reported a higher percentage of women reviewers during the pandemic (47.5%, $N=257$) than before the pandemic (38.0%, $N=519$).

Notably, this organization also reported a total number of reviewers that was lower during the pandemic ($N=541$) than before the pandemic ($N=1,365$). The pandemic decline in reviewers reported by this organization accounted for 99% of the total decline in reviewers across all 12 responding

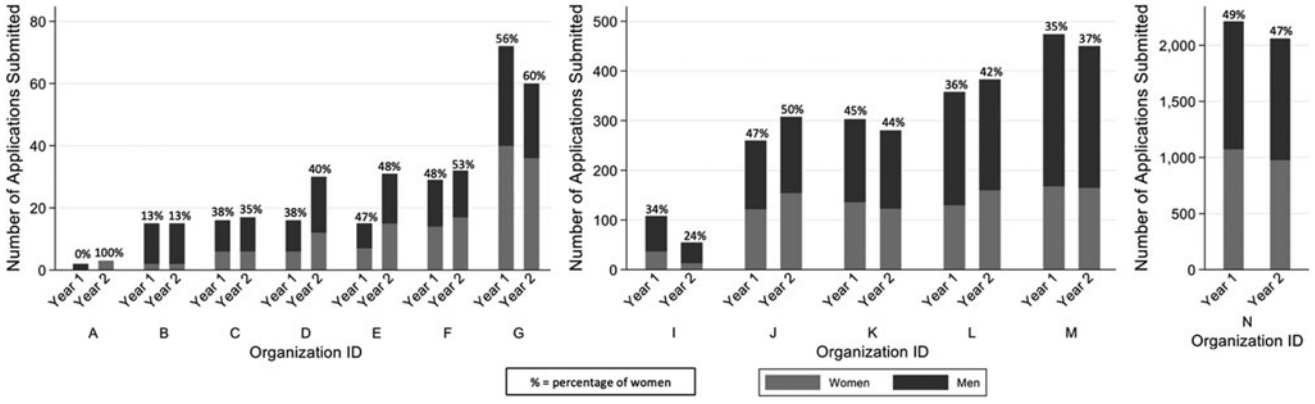

FIG. 1. Number of women and men career development award applicants (and percentage of women applicants) for each organization before (year 1) and during the pandemic (year 2). The *bars* in this figure depict the absolute number of career development award applications submitted by men and by women to each organization in the 10-month periods before and after the pandemic outbreak. The percentage of female applicants is shown at the *top* of each bar. Each responding organization was assigned a *letter* as indicated along the *x*-axis. Organizations that were assigned a *letter* but did not report data about applicants in either time period are excluded. Because organizations varied considerably in the number of submissions received, the data are depicted in three groups with different *y*-axes to allow data from smaller organizations to be visualized. The number of applications is indicated along the *y*-axis.

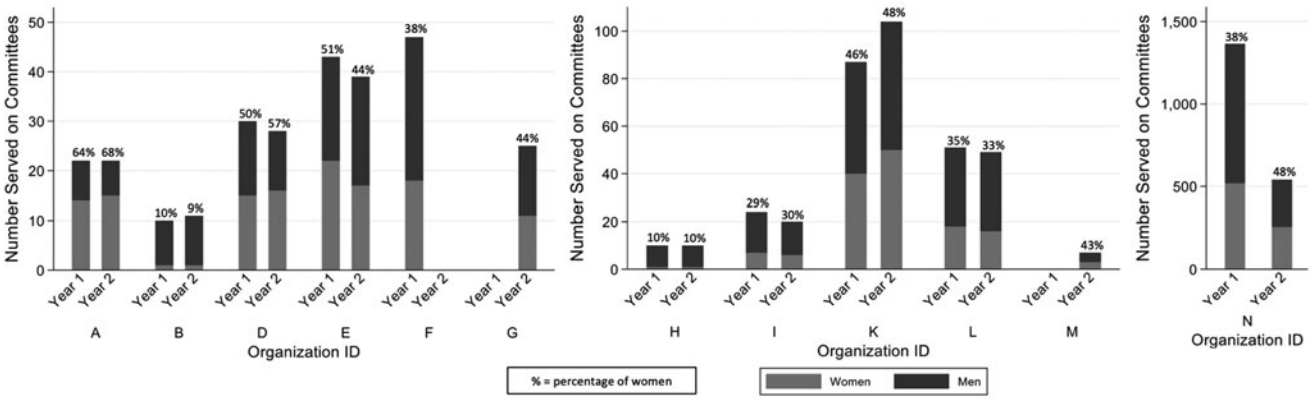

FIG. 2. The number of women and men grant reviewers (and percentage of women grant reviewers) for each organization before (year 1) and during the pandemic (year 2). The *bars* in this figure depict the absolute number of men and women grant reviewers for each organization in the 10-month period before and after the pandemic outbreak. The percentage of female applicants is shown at the *top* of each bar. Each responding organization was assigned a *letter* as indicated along the *x*-axis. Organizations that were assigned a *letter* but did not report data about grant reviewers in either time period are excluded. Because organizations varied considerably in the number of grant reviewers, the data are depicted in three groups with different *y* axes to allow data from smaller organizations to be visualized. The number of individuals who served on grant committees is indicated along the *y*-axis.

organizations. When the largest organization was not included, the percentage of women among grant reviewers before the pandemic was 42.0% and the percentage of women among grant reviewers during the pandemic was 43.2%. Table 2 and Figure 2 displays the number of men and women grant reviewers for each organization before and during the pandemic.

Discussion

In a sample of research funding organizations, we did not observe a significant difference in the total number of grant applicants nor in the percentage of women who applied for career development awards during the pandemic compared with that before the pandemic. The median number of women grant reviewers did not demonstrate significant pre-to-during pandemic differences during the time period we studied.

Given other research suggesting declines in indices of productivity among women in academia, it is interesting to speculate why we did not observe gender differences in career development award applications in this study. Our data were collected from a modest number of nongovernmental funders of health-related research, although they did represent a myriad of specialty areas and a sizable number of individual applicants overall. The selective nature and small size of this sample may have made it difficult to detect gender differences, but the NIH similarly found no evidence of differences in the proportion of women-only grant applications during the pandemic compared with that before the pandemic.[22–24]

Alterations to grant application policies in support of women may also have exerted an effect. During the pandemic, the Canadian Institute of Health Research (CIHR) implemented changes to their grant submission requirements in an effort to promote better gender representation, the results of which were successful at increasing the number of applications from female scientists.[25] NIH also recently announced promising new supplemental funding mechanisms directed toward early career

Table 2. Percentage and Number of Women and Men Grant Reviewers for Each Organization Before (Year 1) and During the Pandemic (Year 2)

	Year 1			*Year 2*		
Organization	*Total* n	*Women: % (*n*)*	*Men: % (*n*)*	*Total* n	*Women: % (*n*)*	*Men: % (*n*)*
A	22	64 (14)	36 (8)	22	68 (15)	32 (7)
B	10	10 (1)	90 (9)	11	9 (1)	91 (1)
D	30	50 (15)	50 (15)	28	57 (16)	43 (12)
E	43	51 (22)	49 (21)	39	44 (17)	56 (22)
F	47	38 (18)	62 (29)	0	0 (0)	0 (0)
G	0	0 (0)	0 (0)	25	44 (11)	56 (14)
H	10	10 (1)	90 (9)	10	10 (1)	90 (9)
I	24	29 (7)	71 (17)	20	30 (6)	70 (14)
K	87	46 (40)	54 (47)	104	48 (50)	52 (54)
L	51	35 (18)	65 (33)	49	33 (16)	67 (33)
M	0	0 (0)	0 (0)	7	43 (3)	57 (4)
N	1,365	38 (519)	62 (846)	541	48 (257)	52 (284)
Overall totals	1,689	39 (655)	61 (1,034)	856	46 (393)	54 (463)

researchers, including administrative supplements for career development awards and funds for childcare costs that may allow for greater engagement in research.[26]

It is possible that HRA organizations who responded to our survey instituted similar policy interventions; this information was not collected in this study and is an important area of inquiry for future research.

In addition, we did not observe any robust pre-to-during pandemic differences in the gender composition of grant review panels. To our knowledge, no prior study has examined pandemic-related changes in grant reviewers; however, Squazzoni et al. found that the pandemic exerted little impact on women's acceptance of requests to peer review articles for scholarly journals.[7] It may be the case that women continue to prioritize their service-related responsibilities despite the stressors of the pandemic and its strain on their available working hours. Although results indicated a significant increase in the percentage of women reviewers during the pandemic compared with that before the pandemic, these results should be interpreted with caution.

The observed increase in the percentage of women among reviewers overall was driven by the largest responding organization, which had a significant reduction in programming during the pandemic period, and thus, a smaller number of individuals recruited to serve as grant reviewers. For this organization during the pandemic, it was the case that the percentage of women reviewers increased within a smaller pool of total reviewers, rather than an increase in the absolute number of women reviewers. Moreover, it is important to note that the median percentage of women reviewers did not change across all organizations.

That said, it is also possible that the flexibility afforded by virtual (as opposed to in-person) grant review panels was particularly beneficial for women, and contributed to the increased percentage of women who were able to serve in this role during the pandemic.

There are several limitations of this study that must be considered. First, data were only collected from a modest number of organizations that chose to participate in our data request and who belonged to a collaboration of nonprofit research funders. The study relied on each organization to ensure that the data submitted were accurate; the authors had no way of externally verifying the information that was provided. Second, binary gender identity was reported by the organizations, which varied in their approaches to collecting this information from applicants and grant reviewers. It will be important for future research to examine the impact of the pandemic upon researchers who identify as gender diverse.[27]

Third, data collected by this study were limited to a 10-month period during the pandemic and a matched 10-month period before the pandemic. If we had access to data that spanned a longer amount of time before and during the pandemic, we may have detected trends that were not apparent in our limited data set. Illustratively, a study of submissions to preprint repositories between 2017 and 2020 found that the proportion of female authors increased yearly until the pandemic, at which time the trend reversed.[28] Other empirical studies illustrate the persistent gender gap in academia that was present well before the onset of the pandemic.

For example, a four decades-long study of authorship between 1970 and 2004 found that women comprised an increasing proportion of first and senior authors, however, women remained a consistent minority of the authors in prestigious medical journals.[21] Fourth, reporting biases are possible such that organizations who are committed to improving gender equity may have been more likely to respond to the survey. It is possible that gender differences in grant applicants and review panels may have been more evident among organizations that did not respond to our request for data.

Fifth, we lacked individual-level information from applicants, such as family and caregiving circumstances, institutional support, and regional differences in shelter-in-place guidelines that may be related to the capacity to submit grants and participate in grant review panels. However, grant applicants were intentionally limited to early career awards. Although there may be some variability in the age of individuals who submit early career awards, this career period is one in which many applicants are often becoming parents or rearing young children. Finally, we examined grant applications only and were unable to evaluate potential gender differences in funded applications.

Although neither a drop in career development award applications overall nor gender differences were observed in this analysis through February 2021, ongoing evaluation of potential inequities in submitted and awarded applications is essential. As the pandemic endures, the cumulative impact of career stressors and caregiving disruptions may exert longer term impacts, particularly related to the diminished generation of new projects.[14] Progress in research areas that are typically led by women scientists may slow or stall without concerted efforts to reduce the attrition of women in academia.[29]

Early in the pandemic, it may have been possible to simply rely on pilot data and work generated before the pandemic to support grant applications; as time passes, previously unnoticed differences in work patterns and productivity may well emerge, particularly for those early in their careers. Similarly, access to the influential opportunity of peer review participation for those more senior in their careers merits monitoring, as the effects of the pandemic have spared no groups from disruptions. Thoughtful partnerships between funding organizations and academic research communities are essential to conduct analyses like those presented here, to monitor and mitigate potential adverse effects on both the vitality overall and the gender diversity of the scientific workforce in the coming years.

Authors' Contributions

D.R. contributed to concept and design, drafting of the article, and critical revision of the article for important intellectual content; K.A.G. carried out statistical analysis, drafting of the article, and critical revision of the article for important intellectual content; N.L.S. and S.E.A. were involved in concept and design and critical revision of the article for important intellectual content; M.T. took care of statistical analysis and critical revision of the article for important intellectual content; and C.M. and R.J. were in charge of concept and design, drafting of the article, critical revision of the article for important intellectual content, and in supervision.

Author Disclosure Statement

D.R. is supported by grants unrelated to this study, including from the National Institute of Mental Health (K23MH113709; R56MH127032) and the California Governor's Office of Planning and Research. K.A.G. has no conflicts or important funding sources that relate to this study. N.L.S. is supported by grants unrelated to this study including National Cancer Institute, (R01CA227479, P30CA056036). S.E.A. is a member of the board of directors of the Health Research Alliance.

M.T. is supported by an unrelated award from the National Institute of General Medical Sciences UL1GM118985. C.M. is supported by several grants unrelated to this study including the National Institutes of Mental Health (R01MH112420), Genentech Charitable Giving (G-80078), the Doris Duke Charitable Foundation (Grant No. 2015211), Weston Haven Foundation, United Health Group, and the California Health Care Foundation. In the past year, she has received one-time speaking honoraria from San Francisco State University and Health Affairs (Journal).

R.J. has stock options as compensation for her advisory board role in Equity Quotient, a company that evaluates culture in health care companies; she has received personal fees from the National Institutes of Health as a special government employee (in her role as a member of the Advisory Committee for Research on Women's Health), the Greenwall Foundation, and the Doris Duke Charitable Foundation. She has received grants for unrelated work from the National Institutes of Health, the Doris Duke Foundation, the Greenwall Foundation, the Komen Foundation, and Blue Cross Blue Shield of Michigan for the Michigan Radiation Oncology Quality Consortium. She has a contract to conduct an investigator-initiated study with Genentech. She has served as an expert witness for Sherinian and Hasso, Dressman Benzinger LaVelle, and Kleinbard LLC.

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Supplementary Material

Supplementary Data

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