A Mixed-Methods Analysis of Gender and Career Status Differences in the Impact of the COVID-19 Pandemic on Underrepresented Postdoctoral Fellows and Early-Career Faculty

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Abstract

Purpose
The lack of racial and ethnic diversity in the biomedical workforce is pronounced and those from underrepresented backgrounds encounter more challenges than their majority counterparts. The extent of the impact of the COVID-19 pandemic on early-career investigators from underrepresented backgrounds is not yet fully understood. To examine the impact of the pandemic on underrepresented early-career biomedical researchers, this study evaluated differences in productivity, research, and psychological well-being by gender and career status.

Method
This was a cross-sectional analysis of preintervention data, collected in September–October 2020, from 220 participants enrolled in the Building Up a Diverse Biomedical Research Workforce study. Participants were from 25 academic medical centers in the United States and were underrepresented early-career researchers. The primary outcomes were agreement on a 5-point Likert scale with pandemic impact statements (e.g., “The COVID-19 pandemic has impacted my ability to conduct research”). Thematic analysis was conducted on responses to 2 open-ended questions assessing the pandemic’s impact.

Results
Most participants were female (79.9%), of non-Hispanic/Latinx/Spanish origin Black/African American (33.2%) or Hispanic/Latinx/Spanish origin (34.1%), and early-career faculty (53.4%). Over half of participants agreed or strongly agreed that the COVID-19 pandemic impacted their ability to work (55.7%) and conduct research (70.7%). Themes from qualitative analysis suggested lower research productivity, concerns about the academic job market and funding, and psychological distress due to the pandemic. Women were more likely to attribute lost productivity and psychological distress to homeschooling and childcare responsibilities. Postdoctoral fellows were concerned about more competition for fewer academic positions.

Conclusions
In this study of early-career underrepresented biomedical researchers, the impact of the COVID-19 pandemic was widely felt by participants, varying by gender and career status. For those postdoctoral fellows and early-career faculty who are underrepresented, it is critical for institutions to offer flexibility in their positions.

People who are underrepresented in biomedical research—those of racial/ethnic minority and/or disadvantaged backgrounds, women, and those with disabilities—disproportionately leave their careers compared with those not from these backgrounds, and there is a pronounced lack of racial and ethnic diversity in the biomedical workforce. Furthermore, those from underrepresented backgrounds encounter more challenges than those who are well represented as they progress through their careers. The pervasive problem of underrepresentation suggests that many early-career investigators may require supplemental career development and support beyond what many mentors are able to offer.

The COVID-19 pandemic immediately affected biomedical researchers. Research labs closed and in-person human subject research was halted. Most states mandated stay-at-home orders. This created immediate difficulties for early-career investigators that included decreased access to core facilities, supplies, clinics/human subjects and team members, as well as less engagement with mentors. Additionally, milestones critical to career progression, such as completing and publishing research and obtaining new funding, were delayed. Faculty job openings fell 70% during the pandemic. Investigators with young families had the additional responsibility of childcare and supporting their children in virtual schooling. The COVID-19 pandemic has disproportionately harmed Black and Hispanic or Latinx people through higher infection, hospitalization, and mortality rates in these groups when compared with White individuals. Yet the impact of the pandemic on the research and careers of underrepresented early-career investigators is unclear.

Building Up (Building Up a Diverse Biomedical Research Workforce) is a cluster-randomized trial being conducted at 25 institutions that tests the effectiveness of a year-long intervention designed to diversify the biomedical workforce.

Supplemental digital content for this article is available at http://links.lww.com/ACADMED/B328.
research workforce. When the COVID-19 pandemic first halted many biomedical research studies, we were in the first year of our trial and well positioned to study the impact of the pandemic on research activities and careers of underrepresented investigators. The objective of this study was to use a mixed-methods approach to characterize and understand the impact of the COVID-19 pandemic on postdoctoral fellows and early-career faculty participating in the Building Up trial, paying particular attention to differences by gender and career status in terms of productivity, research, and well-being.

Method
Design and participants
Data for this analysis came from the baseline assessment of the Building Up study. The online baseline assessment, including questions on the impact of the COVID-19 pandemic, was completed in September–October 2020. The trial enrolled 224 postdoctoral fellows and early-career faculty who are underrepresented in health-related sciences. Using the National Institutes for Health (NIH) definition, all participants were from racial or ethnic groups underrepresented in U.S. health-related sciences, had disabilities (physical or mental impairment that substantially limits one or more major life activity, as described in the Americans with Disabilities Act of 1990), were from disadvantaged backgrounds, or were women. The selection process has been previously described. The trial is being conducted at 25 institutions in the United States and includes 2 intervention arms with varying intensity of 4 intervention components (monthly sessions, networking, coursework, and mentoring) aimed at addressing the issue of the leaky career pathway for underrepresented faculty in biomedical research. A single institutional review board at the University of Pittsburgh approved the protocol. Participants provided electronic informed consent and were informed that their responses were confidential.

Measures
Questions on the impact of the COVID-19 pandemic were developed by a multidisciplinary working group comprising members of the National Research Mentoring Network Research Community (including G.E.W.). Answers to the quantitative and qualitative questions were concurrently collected. The quantitative questions assessed whether changes to participants’ home life due to the COVID-19 pandemic impacted their ability to work, whether the pandemic impacted their ability to conduct research, and what in their life had changed since the pandemic began. Responses were scaled responses and check all that apply.

We also asked participants to respond to open-ended questions, which were qualitatively analyzed: “How has the COVID-19 pandemic impacted your career trajectory?” and “Is there anything else you want us to know about how the COVID-19 pandemic has impacted your professional/academic life (either positively or negatively) in the past 6 months?” For the full list of COVID-19-related questions, see Supplemental Digital Appendix 1, at http://links.lww.com/ACADMED/B328.

Data analysis
We chose an exploratory mixed-methods convergent design using both qualitative and quantitative approaches to gain a comprehensive understanding of the impact of COVID-19 on underrepresented early-career biomedical researchers. We conducted separate analyses of quantitative and qualitative data in parallel.

We analyzed data using SAS statistical software, version 9.4 (SAS Institute, Cary, North Carolina). All reported P values are 2-tailed; P values <.05 were considered statistically significant. As this was predominantly an exploratory cross-sectional analysis, we did not account for multiple comparisons. Differences in the impact of COVID-19 by gender and career status were tested with the Chi-Square test for categorical variables and the Cochran-Armitage test for ordinal variables.

To further understand the impact of COVID-19, we conducted a thematic analysis of responses to the 2 open-ended questions. The primary coder (C.N.P.) developed the draft codebook inductively after reviewing all responses for both questions. The primary and secondary coder (M.S.T.) independently applied the draft codebooks to the same 10 responses then identified and discussed discrepancies together. Next, they revised the initial codebooks to ensure clear, comprehensive, and distinct definitions. Once finalized, the primary and secondary coders independently applied the codebooks to each participant response. To assess interrater reliability, Cohen’s Kappa was calculated for the application of each codebook. There was substantial interrater agreement for both questions (K = 0.71 and K = 0.72 for “How has the COVID-19 pandemic impacted your career trajectory?” and “Is there anything else you want us to know about how the COVID-19 pandemic has impacted your professional/academic life [either positively or negatively] in the past 6 months?”) respectively. We fully adjudicated disagreements before identifying themes. Given the significant overlap in themes emerging between questions, we consolidated them during analysis to create a more complete picture of participant experiences. To complement quantitative analyses, potential differences in themes were also explored by gender and career status.

Results
Participant characteristics
Of the 224 enrolled participants, 220 (98%) completed the preintervention assessment and were included in analysis (Figure 1). Characteristics of the 220 participants are described in Table 1. One hundred ninety-four of 220 participants (88%) responded to the open-ended question, “How has the COVID-19 pandemic impacted your career trajectory?” and 127 (58%) responded to the question, “Is there anything else you want us to know about how the COVID-19 pandemic has impacted your professional/academic life (either positively or negatively) in the past 6 months?” Most participants were female (n = 175, 77.9%), non-Hispanic/Latino/Spanish origin Black/African American (n = 73, 33.2%) or Hispanic/Latino/Spanish origin (n = 75, 34.1%), and early-career faculty (n = 117, 53.4%).

Quantitative findings
Over half of participants agreed or strongly agreed that changes in their home life due to the pandemic greatly impacted their ability to work and over 70% agreed or strongly agreed that the pandemic impacted their ability to
Men and women identified different sources of lost productivity. For men, lost productivity was primarily attributed to delays in research projects, lab shutdowns, and/or institutional policies/actions. For women, lost productivity was attributed to these same reasons, but these were combined with other factors, including increased stress, loss of focus, and increased childcare needs. One participant noted:

Challenges in work–life balance with entire family working and schooling from home. Decreased productivity due to these changes. COVID-19 also impacted my research activities, with several modifications necessary to continue data collection and project progress. —Female, faculty

The pandemic created widespread concern about the future of the academic job market and funding prospects. Participants frequently described anxiety over hiring freezes and their impact on the academic job market. Postdoctoral fellows, compared with faculty, more frequently expressed worry over greater competition for positions and funding. Faculty described fears that decreased research productivity and rescinded requests for applications would create fewer opportunities for funding and career advancement. While men and women raised similar concerns about funding and academic job availability, men mentioned these issues more frequently than women.

Some participants also described current job insecurity. One participant noted that they were told COVID-19 was the reason their postdoctoral fellowship position was
Table 1
Characteristics of Underrepresented Postdoctoral Fellows and Early-Career Faculty, From the Building Up a Diverse Biomedical Research Workforce Trial, 2020

| Characteristic (n = 220) | Measure* |
|-------------------------|----------|
| Age, median (25th–75th percentile) | 36 (33–40) |
| Gender, no. (%) | |
| Male | 43 (19.6) |
| Female | 175 (79.9) |
| Gender minority | 1 (0.5) |
| Race/ethnicity, no. (%) | |
| Hispanic/Latinx/Spanish origin | 25 (11.4) |
| Non-Hispanic/Latinx/Spanish origin | 145 (65.9) |
| White | 29 (13.2) |
| Black/African American | 73 (33.2) |
| Asian | 26 (11.8) |
| Middle Eastern/North African | 3 (1.4) |
| Multi-race | 14 (6.4) |
| Disability, no. (%) | |
| Yes | 11 (5.0) |
| No | 209 (95.0) |
| Career status, no. (%) | |
| Postdoctoral fellow | 102 (46.6) |
| Faculty | 117 (53.4) |
| Changes in my home life due to the COVID-19 pandemic have greatly impacted my ability to work, no. (%) | |
| Strongly agree | 55 (25.1) |
| Agree | 67 (30.6) |
| Neutral | 42 (19.2) |
| Disagree | 31 (14.2) |
| Strongly disagree | 24 (11.0) |
| The COVID-19 pandemic has impacted my ability to conduct research, no. (%) | |
| Strongly agree | 23 (33.3) |
| Agree | 82 (37.4) |
| Neutral | 22 (10.1) |
| Disagree | 29 (13.2) |
| Strongly disagree | 13 (5.9) |
| Changes since the COVID-19 pandemic began, no. (%) | |
| Had to continue to work even though in close contact with people who might be infected | 74 (33.6) |
| Disruptions to work | 124 (56.4) |
| Lack of equipment or resources to work efficiently and effectively | 47 (21.4) |
| Increased workload or work responsibilities | 107 (48.6) |
| Decreased workload or work responsibilities | 19 (8.6) |
| Decreased productivity | 43 (19.6) |
| Increased productivity | 3 (1.4) |
| Difficulties concentrating | 128 (62.7) |
| Increased stress | 93 (42.3) |
| Increased overall stress | 93 (42.3) |
| Increased free time | 14 (6.4) |
| More flexibility in schedule | 93 (42.3) |
| Increased discrimination | 14 (6.4) |
| Strengthened relationships with others | 42 (19.1) |
| More quality time with friends and family | 74 (33.6) |
| Other | 29 (13.2) |
| Number of positive changes since the COVID-19 pandemic began, median (25th–75th percentile) | 1 (0–2) |
| Number of negative changes since the COVID-19 pandemic began, median (25th–75th percentile) | 3 (2–4) |

*The number of participants across categories may not sum to the total due to missing data.
†Includes decreased workload or responsibilities, increased productivity, increased free time, more flexibility in schedule, strengthened relationships with others, and more quality time with friends and family.
‡Includes continued to work even though in close contact with people who might be infected, disruptions to work, lack of equipment or resources to work efficiently and effectively, increased workload or responsibilities, difficulties concentrating, increased financial stress, increased overall stress, and increased discrimination.
terminated; another described how they nearly lost their current position:

I almost became unemployed due to budget issues and hiring freezes. This decreased my productivity and made me feel insecure since I like to think of myself as very productive, but no one seemed to care much about my job security at my workplace. I had to knock on doors to be able to continue doing my job, but now my salary is lower, which makes me feel a bit disappointed about my profession. I used to think that at this time of my life I would be managing my own lab as full-time faculty, but the truth is I could barely keep my current job. —Male, faculty

Perceived lack of academic job availability and personal financial insecurity associated with the pandemic also prompted some participants to consider leaving academia, as one participant described:

COVID has dramatically altered my ability to continue on the timeline I was previously on prior to the pandemic. Because my husband lost his job and was diagnosed with a mental illness, I am now acting as a caretaker in addition to [holding] a full-time job. Since our yearly income is a third of what it once was, I am at risk of not being able to extend my timeline for academic jobs and feel I may be forced into an industry position. I feel tremendous financial pressure to get a higher-paying job, and would love that to be in academia if possible. —Female, postdoctoral fellow

Pandemic-related career and personal factors contributed to self-reported psychological distress. Participants described psychological distress including increased feelings of stress and anxiety and decreased motivation and ability to concentrate. The perceived sources of psychological distress varied. Hiring freezes, lost productivity, distance from family, increased work and/or childcare responsibilities, having to adapt to remote work, and the pandemic itself were all reported as sources of psychological distress. According to a participant:

I feel that the stress associated with the pandemic has caused a deep inability to concentrate and progress in work that I could have done more efficiently. I had constant stress and panic attacks that made me very unproductive. Between the news on television and the stressors at work, there was a 4-month period of being very disheartened. —Female, postdoctoral fellow

Additionally, multiple participants discussed stress, anxiety, and frustration with structural racism and racial health disparities related to COVID-19. Some also mentioned the emotional toll of advocating for minority populations to nonminority colleagues, as described by one participant:

Also, with all of the protests and racial unrest in the country it is very difficult to continue to work in a nondiverse environment. Many of my colleagues do not know anyone that has been impacted by [COVID-19] so they are able to continue on with their daily lives, but I am trying to keep up and I feel like every time things seem to be going better, someone else I know dies. I am tired of waking up to bad news every day and trying to keep a smile on my face. —Female, postdoctoral fellow

Women, more often than men, described psychological distress, and there were differences in the type and source of distress reported by gender. Men often
described increased stress, anxiety, and emotional impact related to career- or job-related factors. Women also tended to describe loss of focus, motivation, and concentration, as well as the negative impacts of social isolation on their mental health. For women, childcare and homeschooling responsibilities were described as significant contributors to stress, encapsulated by the following quote:

The pandemic interrupted childcare for my 2 very small children (3 and 19 months) who need constant attention and redirection. When they were in daycare, my nonclinical days were spent doing work at home (preparing manuscripts). I have been emotionally and mentally exhausted. We have no/limited options for childcare that are reasonable. It has taken me 4 months to finish a single manuscript that I should have completed within a few weeks. I have been unable to sit down and pull together the next project (I was hoping to apply for an NIH K award by the end of the year). I feel torn between trying to be productive and trying to guide my family to stay sane during a pandemic. —Female, faculty

**Discussion**

In this study of early-career underrepresented biomedical researchers, we found that the impact of the COVID-19 pandemic was widely felt, varying by gender and between postdoctoral fellows and early-career faculty. These findings are consistent with those from Bernard and colleagues that show that early-career researchers were more likely than mid-career researchers to be concerned that the pandemic will negatively impact their career trajectory, to report that personal mental and physical health negatively impacted their productivity, and to state that caretaking has made it more difficult to be productive. Information from the qualitative themes shows that both men and women experienced psychological distress as a result of the pandemic. However, the types of distress and the impact of it differed by gender. In particular, women were more likely to attribute lost productivity to factors such as stress and anxiety. This is consistent with other studies showing that women, particularly early-career scientists, are reporting higher levels of stress. Information from the qualitative themes shows that both men and women experienced psychological distress as a result of the pandemic. However, the types of distress and the impact of it differed by gender. In particular, women were more likely to attribute lost productivity to factors such as stress and anxiety. Research has suggested that women, more than men, use social relationships to cope with stress and that social distancing during the pandemic likely exacerbated stress for women through lack of social support. Furthermore, the National Academy of Sciences reports that women are more likely to experience academic isolation, such as limited access to mentors, sponsors, and role models. It is interesting to note that issues related to academic isolation were not mentioned in responses to our qualitative questions. However, our data support the well-documented gender disparity.
in the negative impact of the COVID-19 pandemic on the careers of women, particularly those within early career stages. This suggests the need to allocate greater financial, career, and personal support resources for these early-stage women researchers. This may include supplemental funding to help reclaim lost time during the pandemic, formal mentoring as a signal of institutional commitment, and changes in culture to reduce the negative impact on career outcomes our findings demonstrate and supported by other similar research findings.

Despite psychological distress, both men and women reported that lack of access to research facilities was the biggest contribution to lack of productivity, which is consistent with previous research. We found in qualitative analyses that similar proportions of men and women reported disruptions to their work due to restricted access to research facilities, childcare needs at home, helping children with schoolwork, or caring for family members. However, findings from qualitative analyses described a slightly different experience where women were more heavily impacted by increased childcare and homeschooling responsibilities as a result of the pandemic. Women generally carry greater responsibility in childcare than men but some research has suggested that the pandemic has impacted mothers and fathers with children younger than 18 equally. The pandemic may have increased the amount of time postdoctoral fellows and faculty have available for writing but women have submitted fewer manuscripts for publication submitted fewer first-authored papers, and published less than in 2019.

Research by the NIH indicates that extramural researchers who identify as Black or African American showed less concern about the negative impact of the pandemic on their career trajectory, were more likely to state they had organizational support, and reported no difference compared with White peers in job productivity or the impact of caretaking responsibilities on productivity. Despite this, 63% of researchers who identified as Black or African American, 53% who identified as women, and 51% who identified as Hispanic stated that the civil unrest tied to racism has negatively or somewhat negatively impacted their research productivity. The unique pain of underrepresented individuals dealing with racial trauma is illustrated by our qualitative findings, where one participant said they are trying to “keep up” while working in a “nondiverse environment.” The compounding impact of systemic racism with the COVID-19 pandemic cannot be understated.

Not only are there considerable health disparities related to COVID-19, people of color are also asked to participate in diversity, equity, and inclusion efforts at their institutions. Underrepresented early-career researchers have to cope with the impact of racial trauma and systemic racism while also working to dismantle such systems. These additional responsibilities may be burdensome considering the challenges many already face in advancing their careers. Additionally, these responsibilities are oftentimes uncompensated and not valued in career promotion. There are several areas for structural reform to address these issues such as building systems to recruit and retain underrepresented faculty and to improve the sense of belonging at institutions. Moreover, when considering recognition for scholarship, academic institutions should recognize the disproportionate impact on productivity that the pandemic and systemic racism has had on parents, women, and faculty of color.

Limitations

Our study has several limitations. First, our sample was obtained from a randomized trial designed to test an intervention for people from underrepresented backgrounds. While the sample is drawn from 25 U.S. academic medical centers, it is not representative of all early-career scientists. Second, the sample size is small compared with some other studies. Third, the pandemic is still ongoing, and its long-term impacts are unclear. Therefore, the perspectives of participants will likely change over time. Future studies should longitudinally measure the lasting impact of the pandemic in this population. Additionally, the survey responses are self-reported and measure participants’ perception of the impact of the COVID-19 pandemic rather than objective measures. However, many of these measures are intentionally subjective in nature. Furthermore, thorough qualitative methods such as one-on-one interviews or focus groups would have provided more depth and possibility for follow-up questions. Our analysis was exploratory in nature and allowed us to collect responses from a representative sample of Building Up participants. The themes we identified here can inform development of one-on-one interviews and focus groups on this topic. Finally, this study does not include a comparison group of well-represented early-career researchers. It is possible that underrepresented individuals have experienced the impact of the COVID-19 pandemic more acutely since it disproportionately affected underrepresented communities.

Conclusions

To our knowledge, this is one of the first studies to use mixed methods to characterize the impact of the COVID-19 pandemic on the lives and careers of early-career biomedical researchers from underrepresented backgrounds, paying particular attention to differences by gender and postdoctoral fellow or faculty status. Most participants reported disruptions to work, difficulties concentrating, and increased stress since the pandemic began. In particular, women from underrepresented backgrounds were disproportionately affected by the pandemic. For those who are from underrepresented backgrounds and early in their academic research careers, it is critical for institutions to offer postdoctoral fellows and early-career faculty flexibility in their positions. Expectations for productivity need to be adjusted, promotion and tenure clocks extended, and technology support given so they can work efficiently from home. Additionally, institutions and funding agencies may consider offering childcare support as a means of helping those who are early in their careers to balance the additional responsibilities.

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