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The Impact of COVID-19 on the Careers of Women in Academic Sciences, Engineering, and Medicine

Spring 2020 changed how nearly everyone conducted their personal and professional lives, within science, technology, engineering, mathematics, and medicine (STEMM) and beyond. For academic STEMM, the disruptions caused by the COVID-19 pandemic ranged from delayed experiments in individual laboratories to cancelled global scientific conferences. People shifted classes to virtual platforms and negotiated with family members for workspace in their homes. This changed reality blurred the boundaries between work and nonwork, infusing ambiguity into everyday activities. While adaptations allowed people to stay connected, the evidence available at the end of 2020 suggested that the disruptions caused by the COVID-19 pandemic endangered the engagement, experience, and retention of women in academic STEMM.

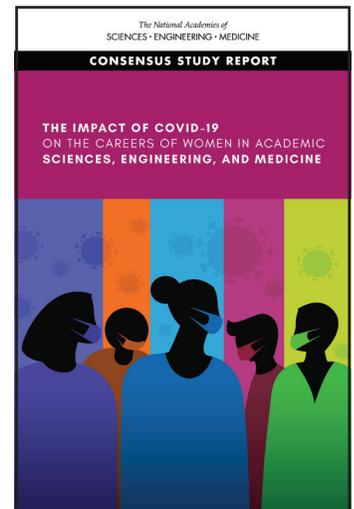
ABOUT THE REPORT

During 2020, there was a need to expeditiously identify, name, and document how the COVID-19 pandemic disrupted the careers of women in academic STEMM, and to consider how these disruptions—both positive and negative—might shape future progress for women in academic STEMM. Charged with building on the *Promising Practices* report,¹ the committee's task was to examine the COVID-19 pandemic's potential influences on women in academic STEMM.

The committee sought a comprehensive understanding of how the disruptions of 2020 manifested to help the academic community emerge from the COVID-19 pandemic ready to mitigate the potential long-term negative consequences, particularly on the continued advancement of women in the academic STEMM workforce. They also wished the academic community might build on the adaptations and opportunities that emerged during the course of the COVID-19 pandemic.

The information and experiences the committee assembled represent a description of what was known by the end of 2020. While the report may help inform the decisions that academic leaders, funders, other interested stakeholders, and both current and aspiring academics will continue to have to make over the course of the COVID-19 pandemic, the charge to the committee was to inform, without making recommendations. Academic leaders and key decision makers may use the committee's findings as they look for new ways to engage and move forward in creating a more equitable and inclusive higher education and research system. In addition, the lessons that can be gleaned from the first several months of the COVID-19 pandemic may be applicable to other large-scale disruptions (e.g., climate-change-related events, severe economic recessions, or other novel infectious disease outbreaks) that will continue to be risks faced by the STEMM enterprise over time.

¹ National Academies of Sciences, Engineering, and Medicine (2020). *Promising Practices for Addressing the Underrepresentation of Women in Science, Engineering, and Medicine: Opening Doors*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25585>.



The future almost certainly holds additional, unforeseen disruptions that will test the principles and resilience of institutions of higher education. It also almost certainly requires the contributions of STEMM, which can be fully realized only if the well-being of women in these fields does not significantly suffer from the COVID-19 pandemic and other disruptions.

ESTABLISHED RESEARCH AND EXPERIENCES FROM PREVIOUS EVENTS

Advances in knowledge and practice in academic STEMM demand and benefit from a diversity of perspectives, including people who represent different genders, ethnicities, and ancestries. However, women remain underrepresented in STEMM, with societal and institutional inequities contributing both to this persistent underrepresentation and to the disproportionate burdens many women face in academic STEMM fields.

The organizational structures of colleges and universities, as well as the leadership and the decision-making context, are important determinants of gender equity. Research shows that women are less likely to receive either mentoring or benefit from the sponsorship of senior academics, have limited or no access to support structures, have less access to networks that would help them to move up in the ranks of administration, and become more isolated as they advance in the academic hierarchy.

Institutional policies have often incentivized successful tenure-track faculty to secure substantial grants, patents, and licenses, while those same policies place a lower value on service work, mentoring, and student support—typically taken on by women and Faculty of Color—when it comes to deciding on tenure and promotion. However, nearly 70 percent of faculty are not on the tenure track, and women are over represented in this group.

During stressful times, those who are systemically disadvantaged are more likely to experience additional strain and instability than those who have an established reputation, a stable salary commitment, and power. Women of Color are affected more significantly than others, given the layering of gender-bias and racism contributing to their career trajectories. In STEMM, desirable attributes are generally granted to those who adhere to masculine and majority norms. Women in academic STEMM are more likely than men to be early in their career, have a lower salary regardless of professional ranking in STEMM, be a single parent or a primary caregiver, and report experiencing greater work-related stress and discrimination in the workplace or their community. In addition, the caregiving responsibilities that often fall on the shoulders of women cuts across career time line and rank.

Related Findings

Finding 1: Women’s Representation in STEMM: Leading up to the COVID-19 pandemic, the representation of women has slowly increased in STEMM fields, from acquiring Ph.D.s to holding leadership positions, but with caveats to these limited steps of progress; for example, women representation in leadership positions tend to be at institutions with less prestige and fewer resources. While promising and encouraging, such progress is fragile and prone to setbacks especially in times of crisis.

Finding 2: Confluence of Social Stressors: Social crises (e.g., terrorist attacks, natural disasters, racialized violence, and infectious diseases) and COVID-19 pandemic-related disruptions to workload and schedules, added to formerly routine job functions and health risks, have the potential to exacerbate mental health conditions such as insomnia, depression, anxiety and post-traumatic stress. All of these conditions occur more frequently among women than men.² As multiple crises coincided during 2020, there is a greater chance that women will be affected mentally and physically.

Finding 3: Intersectionality and Equity: Structural racism is an omnipresent stressor for Women of Color, who already feel particularly isolated in many fields and disciplines. Attempts to ensure equity for all women may not necessarily create equity for women across various identities if targeted interventions designed to promote gender equity do not account for the racial and ethnic heterogeneity of women in STEMM.

IMPACTS OF THE COVID-19 PANDEMIC DURING 2020

The preliminary evidence indicates that the COVID-19 pandemic has negatively affected the productivity, boundary setting and boundary control, networking and community building, and mental well-being of women in academic STEMM. Collaborations have been disrupted, career progression paused, and women are facing challenges associated with gendered effects of remote work conflicting with caregiving responsibilities.

Because women were underrepresented across most STEMM fields, women are more likely to experience academic isolation, including limited access to mentors, sponsors, and role models that share gender, racial, or ethnic identities. Coupled with the physical isolation stipulated by public health responses to the COVID-19 pandemic, women in academic STEMM have been isolated within their fields, networks, and communities.

² This finding is primarily based on research on cisgender women and men.

Furthermore, women working in STEM disciplines have begun to experience additional disruptions that may affect their academic productivity and careers. Preliminary evidence from 2020 suggests that the COVID-19 pandemic affected women's ability to engage actively in collaborations. For women in STEM with caregiving responsibilities, many had significantly less time in the day to network and engage in collaborations because of increased non-work tasks. Women's shares of first authorships, last authorships, and general representation per author group as well as overall team size have decreased during the COVID-19 pandemic.

With variations by discipline, women also published fewer papers and received fewer citations of their work between March 2020 and December 2020, which may affect their job stability and future ability to obtain funding. Moreover, the COVID-19 pandemic has exacerbated many stresses women in academia face under usual conditions. For example, delays in obtaining clearance for conducting research during 2020, a result of the COVID-19 pandemic, lead researchers to experience increased burnout, sleep disturbance, and poor appetite; increased interpersonal problems; and decreased motivation.

Women faculty in STEM faced unique challenges resulting from the COVID-19 pandemic related to alterations to healthy boundaries between the multiple roles women assume (e.g., as caregivers and professionals). While remote work can facilitate the management of work-nonwork roles, it also increases multi-tasking, interruptions, and work availability that may harm mental health and well-being. In addition, several studies have shown there are health and well-being implications of the unequal childcare responsibilities. To cope with additional caregiving demands, women are reducing their work hours.

Postsecondary institutions and funders also found themselves in uncharted territory during 2020, and have responded in several ways. Tenure clock extensions were widely implemented to address faculty productivity challenges. However, these policies were often implemented without accounting for disparities in caregiving and job-related workload that women faculty faced. Many funders modified policies to allow researchers greater flexibility in 2020, but there was often limitation on funding over the long-term. The 1-year extensions and flexibility were helpful, but overall, the differential effects for women may not have been accounted for.

Along with these potential negative effects, the COVID-19 pandemic may be catalyzing changes that could portend a better future for women in academic STEM. For example, professional conferences adapted quickly to virtual platforms, allowing global participation, and often increasing access by removing travel-related barriers that can affect women more than men, given their caregiving responsibilities. There were also some emerging data by the end of 2020 indicating that approaches some academic leaders used to make decisions, govern, and be accountable were more gender inclusive and may help to eradicate growing equity gaps. Some campuses began to think about the long-term implications of the COVID-19 pandemic and suggested strategies to address this issue, such as revised strategic plans aimed at ameliorating equity gaps. However, budget cuts made by many colleges and universities in response to the economic constraints that arose during 2020 greatly affected contingent and non-tenured faculty members—positions disproportionately occupied by women and People of Color. Taken together—positive and negative—it is important to identify and illuminate the ways that the COVID-19 pandemic has affected and will affect women in academic STEM for years to come.

Related Findings

Finding 4: Academic Productivity: While some research indicates consistency in publications authored by women in specific STEM disciplines, like earth and space sciences, during 2020, several other preliminary measures of productivity suggest that COVID-19 disruptions have disproportionately affected women compared with men. Reduced productivity may be compounded by differences in the ways research is conducted, such as whether field research or face-to-face engagement with human subjects is required.

Finding 5: Institutional Responses: Many administrative decisions regarding institutional supports made during 2020, such as work-from-home provisions and extensions on evaluations or deliverables, are likely to exacerbate underlying gender-based inequalities in academic advancement rather than being gender neutral as assumed. For example, while colleges and universities have offered extensions for those on the tenure track and federal and private funders have offered extensions on funding and grants, these changes do not necessarily align with the needs expressed by women, such as the need for flexibility to contend with limited availability of caregiving and requests for a reduced workload, nor do they generally benefit women faculty who are not on the tenure track. Further, provision of institutional support may be insufficient if it does not account for the challenges faced by those with multiple marginalized identities.

Finding 6: Institutional Responses: Organizational-level approaches may be needed to address challenges that have emerged as a result of the COVID-19 pandemic in 2020, as well as those challenges that may have existed before the pandemic but are now more visible and amplified. Reliance on individual coping strategies may be insufficient.

Finding 7: Work-Life Boundaries and Gendered Divisions of Labor: The COVID-19 pandemic has intensified complications related to work-life boundaries that largely affect women. Preliminary evidence from 2020 suggests women in academic STEM are experiencing increased workload, decreased productivity, changes in interactions, and difficulties from remote work caused by the COVID-19 pandemic and associated disruptions. Combined with the gendered division of nonemployment labor that affected women before the pandemic, these challenges have been amplified, as demonstrated by a lack of access to childcare, children's heightened behavioral

and academic needs, increased eldercare demands, and personal physical and mental health concerns. These are particularly salient for women who are parents or caregivers.

Finding 8: Collaborations: During the COVID-19 pandemic, technology has allowed for the continuation of information exchange and many collaborations. In some cases technology has facilitated the increased participation of women and underrepresented groups. However, preliminary indicators also show gendered impacts on science and scientific collaborations during 2020. These arise because some collaborations cannot be facilitated online and some collaborations face challenges including finding time in the day to engage synchronously, which presents a larger burden for women who manage the larger share of caregiving and other household duties, especially during the first several months of the COVID-19 pandemic.

Finding 9: Networking and Professional Societies: During the COVID-19 pandemic in 2020, some professional societies adapted to the needs of members as well as to broader interests of individuals engaged in the disciplines they serve. Transitioning conferences to virtual platforms has produced both positive outcomes, such as lower attendance costs and more open access to content, and negative outcomes, including over-flexibility (e.g., scheduling meetings at non-traditional work hours; last-minute changes) and opportunities for bias in virtual environment.

Finding 10: Academic Leadership and Decision-Making: During the COVID-19 pandemic in 2020, many of the decision-making processes, including financial decisions like lay-offs and furloughs, that were quickly implemented contributed to unilateral decisions that frequently deviated from effective practices in academic governance, such as those in crisis and equity-minded leadership. Fast decisions greatly affected contingent and nontenured faculty members—positions that are more often occupied by women and People of Color. In 2020, these financial decisions already had negative, short-term effects and may portend long-term consequences.

Finding 11: Mental Health and Well-being: Social support, which is particularly important during stressful situations, is jeopardized by the physical isolation and restricted social interactions that have been imposed during the COVID-19 pandemic. For women who are already isolated within their specific fields or disciplines, additional social isolation may be an important contributor to added stress.

Finding 12: Mental Health and Well-being: For women in the health professions, major risk factors during the COVID-19 pandemic in 2020 included unpredictability in clinical work, evolving clinical and leadership roles, the psychological demands of unremitting and stressful work, and heightened health risks to family and self.

RESEARCH QUESTIONS

While this report compiled much of the research, data, and evidence available in 2020 on the effects of the COVID-19 pandemic, future research is still needed to understand all the potential effects, especially any long-term implications. The committee laid out 31 research questions to help enable academic STEM emerge from the pandemic era a stronger, more equitable place for women.

The research questions range from tackling remaining issues about the effects of the COVID-19 pandemic on women's participation in STEM, particularly for Women of Color, through how policies and practices such as extensions may affect the short- and long-term career trajectories of women. Other questions explore challenges and insights gained from work-life management, especially for parents and other caregivers or the changed nature of connectivity and conferencing. Additional questions probe models of leadership, potential institutional change, and how colleges and universities can support their academic STEM workforce during and after societal stressor events like the COVID-19 pandemic. Together, the findings and research questions can help better prepare higher education institutions to respond to disruptions and explore opportunities that support the full participation of women in the future.

For More Information... This Consensus Study Report Highlights was prepared by the Committee on Women in Science, Engineering, and Medicine based on the Consensus Study Report: *The Impact of COVID-19 on the Careers of Women in Academic Sciences, Engineering, and Medicine* (2021). The study was sponsored by the National Institutes of Health, National Science Foundation, National Institute of Standards and Technology, Alfred P. Sloan Foundation, and the Doris Duke Charitable Foundation. Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project.

Copies of the Consensus Study Report are available from the National Academies Press, (800) 624-6242; <https://www.nap.edu>.

Policy and Global Affairs Committee on Women in Science, Engineering, and Medicine

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