Preventing a Secondary Epidemic of Lost Early Career Scientists: Effects of COVID-19 Pandemic on Women with Children

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Novel coronavirus-2019 (COVID-19) has reached pandemic levels with over 9 million infections and over 475,000 deaths worldwide.(1) Millions of people are on “stay-at-home” orders, universities have prohibited in-person classes, and schools and childcare centers have closed indefinitely. As a result, scientists are now working from home, converting their classes to an online platform, often while simultaneously caring for their children.

Prior to this pandemic, early career women investigators faced significant barriers to academic success.(2) Given that prime reproductive years generally overlap with the early stage of scientific careers, 4 out of 5 physician-scientists have children during this time.(3) As such, family planning milestones (i.e., marriage and childbirth) occurring during this time period account for the largest loss of women in the academic pipeline, a finding that is not observed in men.(4, 5) This loss is highlighted by a 2019 study among science, technology, engineering, mathematics (STEM) faculty that reported 43% of women (as compared to 23% of men) left full-time STEM employment after having their first child, loss rates that are significantly higher than faculty without children.(6) Further, studies have shown that even among high-achieving early career physicians and researchers, women take on significantly greater domestic and childcare responsibilities and are less likely to have a stay-at-home partner, as compared to men.(3) Together, these issues contribute to well-documented gender disparities in academia.(2)

During this pandemic, women are disproportionately bearing the load of additional full-time caregiving and homeschooling responsibilities,(7, 8) and those with very young children (ages 0-5) report significant decreases in hours worked and academic productivity.(7) Though still early in the pandemic, decreased productivity among women is already evident, with

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overall manuscript submissions on a downward trend among women compared to men, and women making up only 12% of the authors of COVID-19-related research.(9) Meanwhile, those without children at home during “stay-at-home” orders report significantly increased measures of productivity.(7) Thus, domestic burdens and childcare responsibilities are being amplified during COVID-19 and their combined impact on career productivity and funding acquisition will result in a triple-threat to tenure and/or promotion for early career women. A powerful piece published by 35 women scientists highlights the difficulty of these times, detailing that women in STEM are not only fighting COVID-19, but also the patriarchy, resulting in desires to leave academia altogether.(10) Lack of support and resources for women scientists will lead to a secondary epidemic of lost early career physicians and scientists, particularly among those already vulnerable to leaks in the academic pipeline (e.g., early career women and women of color)(2). This will undo a great deal of the progress made regarding representation in STEM and result in a less diverse workforce.(10) Less diverse scientific workforces clearly produce science that less effectively meets the needs of our diverse nation and world.(11)

We challenge academic institutions and funding agencies to carefully strategize their approach toward the management of consequences resulting from the pandemic to sustain their future competitiveness and impact. Feasible policies and strategies can be implemented (see Table 1) — those proposed herein provide actionable policies and procedures to create a safety net for all caregivers following the COVID-19 pandemic, particularly focusing on the needs of women early career investigators.

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Childcare Responsibilities

Academic work, including manuscript and grant writing, requires a significant amount of focus and attention. Caregiving responsibilities are incompatible with scientific productivity, where we engage in “intellectual jumping jacks” all day. Without childcare available, scientists are incapable of producing at typical capacity or managing their teams efficiently.(12) Creating and identifying safe ways to obtain family care is essential; without it, sustained productivity is fundamentally impossible and equal opportunities to success become eliminated. Thus, we propose the following suggestions:

- **Create an infrastructure for identifying family care resources while schools and childcare facilities remain closed, and other caregiving resources are limited.** Some academic institutions have begun to create internal marketplaces wherein those without current work at the institution can list themselves and their skills for jobs they would be willing to do. This infrastructure could be used, in part, for child or elder care services and could provide financial subsidy for those waiting to return to their prior jobs. Though some departments and facilities have done this at a grassroots level, our suggestion is for all institutions to create a widespread infrastructure for this to occur.
- **Accommodate flexible working arrangements.** Given the continued uncertainty of the pandemic, flexible and/or work-from-home arrangements are necessary for researchers. Some researchers may need to share family care responsibilities with a partner and will likely deviate from a standard schedule. To avoid overburdening early career scientists and clinician scientists, academic institutions should actively facilitate and encourage

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discussions about creative solutions to overcome challenges presented by COVID-19 (e.g., virtual schooling hours for children). Facilitation of alternate working arrangements will allow faculty to achieve maximum productivity while still meeting family needs. Institutions or departments that demand a physical presence in the office and/or adherence to a pre-defined set of hours can create a situation where individuals must choose either family wellbeing or their job. This is a 'lose-lose situation' for all and institutions risk losing faculty who are unable to comply, contributing to a further loss of diversity in the workplace.

Funding

Acquiring and maintaining grant funding is a key component to a successful career in academia. From 2006 to 2017, only 43.6% of National Institutes of Health (NIH) grants given to first-time primary investigators were women, with median funding at $126,615 for women and $165,721 for men.(13) Thus, even before the COVID-19 pandemic, women were experiencing disparities aligned with a key factor for success within academic careers. Given that caregiving responsibilities and "stay-at-home" orders will provide additional barriers for submission and success of grant proposals, academic institutions and other funding agencies have an opportunity to revise existing policies and create new ones in response to the emerging needs of early career researchers with caregiving responsibilities during these unique times. We suggest:

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- **Develop 'women-only' funding opportunities.** Develop 'women-only' pilot and career development award opportunities given the unique vulnerabilities and underrepresentation of women and women of color in science.(2)
- **Extend currently funded grant periods.** Automatically extend currently funded grants for early career researchers as a no-cost, one-year extension. This will decrease the potential for negative perceptions related to the need for a no-cost extension at future times of career evaluation.
- **Offer administrative supplements to offset resource loss during the pandemic.** Offer administrative supplements to existing grants for early career investigators to account for extra time and costs resulting from changes to study protocols and timelines, and continued payment of personnel amid suspended research during the COVID-19 pandemic.
- **Extend grant submission periods.** Allow for grant submission extensions in the year following the pandemic for those who can provide justification (e.g., caregiving responsibilities or diagnosis of COVID-19 for themselves or a family member). This benefit is already provided to members of NIH standing study sections as a recognition of the social importance of their service and could easily be extended to others.
- **Increase funding opportunities for early career researchers.** Pools of funding dedicated to early career researchers (e.g., NIH F31, F32, T32, and K-level awards) should be increased. Further, identifying, diverting, or creating institutional pilot funds for early career investigators who are caregivers and require additional support could prove beneficial (e.g., single parents, parents of young children, those with elder care

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responsibilities). NIH has created similar funding opportunities to support investigators who are returning to the scientific workforce after interruption for family responsibilities (93% are women), and demonstrate funding support is related to publications, application for independent research grants, and acquisition of assistant or associate professor positions after reentry.(14) Accommodations and funding extensions for graduate students and postdoctoral fellows may also be necessary, as many may need additional time to complete projects, particularly those who are caregivers.

Managing Promotion and Tenure

Teaching, service, research, and clinical time can all play a significant role in tenure and/or promotion; however, research, teaching, and clinical time lead to greater prestige and are considered the pillars for academic promotion, whereas service is recognized but not considered critical.(2, 15) Prior to COVID-19, national survey data found that women spend 31 more hours per year conducting service-related work than men (16), with disproportionate loads even more pronounced among faculty of color (17). COVID-19 has presented additional service opportunities (e.g., serving on a COVID-19-related task force), though participation is unlikely to improve odds of tenure or promotion. Thus, implementation and evaluation of policies to ensure equity in service loads and academic promotion is essential. It is also crucial to be mindful of blanket policies that could unintentionally lead to widened disparities among varied groups. This has happened previously, as with the well-intentioned, gender-neutral,

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clock-stopping family policies, where data demonstrated that adoption of gender-neutral tenure clock-stopping policies substantially reduced tenure rates of women while substantially increasing tenure rates of men.(18) Thus, we suggest:

- **Editors should consider and prioritize gender and racial/ethnic equity when considering scientific manuscripts for publication in their journals.** Editors can place a greater focus on women-authored papers by conducting special issues written by women-led teams. Additionally, editors should consider tracking metrics and monitoring the number of manuscripts published with women and/or racial/ethnic minorities in first- and senior-author positions, and make needed changes to achieve equity.
- **Monitor demographic breakdowns in tenure and promotion.** Institutions should regularly monitor gender and racial/ethnic breakdowns in tenure and promotion, and work to correct these discrepancies. This can be accomplished by implementing an academic equity council that analyzes inequities of pay, time to tenure and promotion, and metrics of endowments. Though this is an essential policy at all times, it is particularly relevant in the decade to come following the COVID-19 pandemic.(2)
- **Carefully monitor allocation of new teaching and service loads.** Many universities are cutting back on adjuncts and lecturers, creating increased and disproportionate demand for formal teaching and informal mentoring.(17, 19) These additional teaching and service loads must not be disproportionately placed on women or racial/ethnic minorities.
- **Evaluate policies implemented during or as a result of COVID-19.** Institutions should assess the effect of any implemented policies to ensure there are no unintended

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consequences resulting in magnification of disparities, particularly among racial/ethnic minorities and women, for whom many disparities already exist.(2, 3, 6, 13, 18, 20) Best practices should be disseminated widely and shared across institutions.

- **Conduct a needs assessment.** Each institution and department will have unique barriers and facilitators to success for vulnerable faculty. We encourage academic institutions to proactively reach out to women academics to conduct needs assessments. In our collective experience across a variety of academic settings, early career investigators are goal- and solution-oriented, often teeming with ideas that could improve the cultural environment of an institution and decrease losses among some of the more vulnerable sectors of the workforce.
- **Reinvent what success in academia looks like.** Re-defining what academic success looks like and putting more emphasis on scientific *impact* beyond traditional metrics of manuscripts and grants, could help move science forward and alleviate gender and racial/ethnic disparities in tenure and promotion. This could include the addition of metrics related to science communication, community-based implementation, dissemination (e.g., Altmetric scores), effective mentoring, and advocacy work.

Conclusion

The COVID-19 pandemic has raised a magnifying glass to many disparities within our society, including inequities for caregivers who are predominantly women. In this call to action, we have identified actionable strategies and resources for promoting inclusive excellence following the

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unintended, yet damaging consequences of COVID-19 on the potential success of early career academic women. Moreover, the data we present herein can be used to appeal to state policymakers, who influence over funding allocations will affect the extent to which an institution can implement the recommended changes. This is also an opportunity for individuals who are not affected by these issues to recognize their presence and use their voice to speak out. Similar to addressing issues of racial/ethnic inequalities in science and health, we have a stronger voice when the majority voice and the marginalized voice work together to create change.

Importantly, we recognize nearly everyone in the world has encountered substantial barriers and difficulties during the COVID-19 pandemic. This piece highlights the problems that have been prevalent for a subset of academics—women early career investigators with family responsibilities—and addresses their specific issues. However, lessons learned in this context could help inform strategies to recruit and retain all women within academia, regardless of caregiving status, racial/ethnic minority status, or membership of another underrepresented group. It is critical that academic institutions work to proactively retain their early career researchers who may leave academia if the necessary support is not provided. Structural changes such as those we suggest will be crucial to prevent a secondary epidemic of lost early career scientists.

If there is one thing this pandemic has reminded us of, yet again, it is that equity and justice requires concrete and widespread commitment, and implementation and evaluation of policies to address inequalities.

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Table 1. Summary of Recommendations and Implemented Examples Demonstrating Feasibility

1. Childcare Responsibilities	
Recommended Action	**Example of Implemented Action**
Create an infrastructure for identifying childcare resources while schools and childcare facilities remain closed, and other caregiving resources are limited.	Some academic centers have created an internal marketplace wherein those without current work at the institution can list themselves and their skills for jobs they would be willing to do: University of Florida: https://ufhealth.org/news/2020/uf-medical-and-pa-students-volunteer-child-care-and-household-help-uf-health-employees University of Washington: http://uwhires.admin.washington.edu/eng/candidates/HRFormsExt/uwc3fam.aspx
Accommodate flexible working arrangements.	Several academic workplaces have identified the necessity for flexible working arrangements for faculty/staff including ways to facilitate the process: The City University of New York: https://www.cuny.edu/coronavirus/flexible-work-arrangements/ Researchers from Northwestern University: http://faculty.wcas.northwestern.edu/~mdo738/research/COVID19_Gender_March_2020.pdf
2. Funding	
Increase funding opportunities for early career researchers.	Some organizations have increased support for early-stage research projects by identifying new research grant opportunities: NBER: https://www.nber.org/callforpapers/2020grantsonwomenvictimizationandcovid19.html NIBIB: https://grants.nih.gov/grants/guide/pa-files/PAR-20-084.html
Develop 'women-only' funding opportunities.	'Women-only' funding mechanisms have become available to female-founded businesses as well as small minority and women of color businesses impacted by COVID-19: The Stacy's Rise Project: https://stacysrise.helloalice.com/ Shea Moisture: https://www.sheamoisturefund.com/about
Extend currently funded grant periods.	The NIH has approved the no-cost extension of currently funded grant periods for up to one year: https://grants.nih.gov/grants/guide/notice-files/NOT-OD-20-086.html
Offer administrative supplements to offset resource loss during the pandemic.	The NSF is offering administrative relief with the ability to charge costs to grants that would not normally be allowed (i.e., travel/event cancellations, costs associated with the pause and/or restart of research activities): https://www.nsf.gov/bfa/dias/policy/covid19/covid19_nsfombimplementation.pdf
Extend grant submission periods.	To provide potential applicants more time to submit their applications to RFA-HL-19-015, the NIH NHLBI has added a second receipt date for the last application cycle: https://grants.nih.gov/grants/guide/notice-files/NOT-HL-20-793.html
3. Managing Promotion and Tenure	

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Editors should prioritize women-authored papers.	One journal has a call out to highlight gender issues in science and the work of female researchers. Specifically they invite papers authored by female-led research teams or focused theoretically or empirically on women: https://www.journals.elsevier.com/personality-and-individual-differences/call-for-papers/women-in-personality In 2019, *The Lancet* published an entire women-focused issue: https://www.thelancet.com/journals/lancet/issue/vol393no10171/PIIS0140-6736(19)X0006-9
Monitor gender breakdowns in promotion and tenure.	University of Texas has created a council dedicated to overseeing gender equity in faculty salaries, promotion, and endowments: https://provost.utexas.edu/faculty-affairs/gender-equity-council
Carefully monitor allocation of new teaching and service loads.	Faculty recommendations have been developed featuring essential advice/tools for adaptation that includes monitoring teaching loads (excerpts from *The Chronicle Guide to Coronavirus and Your Career*): https://www.chronicle.com/article/How-the-Coronavirus-Will/248750?cid=cp275
Evaluate policies implemented during or as a result of COVID-19.	Recommendations for evaluating the ongoing implementation of COVID-19 policies have been derived (excerpts from *The Chronicle Guide to Coronavirus and Your Career*): https://www.chronicle.com/article/How-the-Coronavirus-Will/248750?cid=cp275 University of Illinois System has created a task force to characterize the effects of the pandemic on economics, health, healthcare, communities, and policies: https://igpa.uillinois.edu/page/igpa-covid-19-pandemic-task-force
Reinvent what success in academia looks like.	The Australian Academy of Science has developed a plan for addressing equity for women in STEM, providing numerous suggestions for how to move forward to achieve a strong, equitable STEM workforce: https://www.science.org.au/files/userfiles/support/reports-and-plans/2019/gender-diversity-stem/women-in-STEM-decadal-plan-final.pdf

*in order aligned with manuscript

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