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Supporting Caregivers Working in STEM: Qualitative Study Report

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PURPOSE AND AIMS

The Committee on Women in Science, Engineering, and Medicine (CWSEM) of the National Academies of Sciences, Engineering, and Medicine commissioned a small, qualitative study to complement its broader review of promising practices for supporting family caregivers working in science, engineering, and medicine.

The study was designed to address critical gaps in evidence on the challenges facing science, technology, engineering, and mathematics (STEM) students and professionals with caregiving responsibilities and promising strategies for supporting them, particularly caregivers of color. The National Academies contracted with a research team in the Transformative Research Unit for Equity at RTI International, a not-for-profit research institute, to carry out the study.

The study addressed two research questions:

1. How do macro-level factors (including community cultural wealth and structural disadvantage), meso-level factors (including everyday interactions within institutions and social support networks), and micro-level factors (including personal identities, priorities, and household composition) shape the ways that caregivers working and studying in academic STEM fields
 - a. engage in and make meaning of various forms of caregiving?
 - b. navigate work-life balance and access policies and procedures designed to support it?
2. What alternative structures, standards, norms, and supports might better promote work-life balance for caregivers in academic STEM, particularly caregivers of color?

In keeping with the focus of the committee on addressing gaps in the existing evidence base, each of these questions was engaged with a central focus on the experiences of women of color and caregivers of intersecting marginalized identities.

METHODS

Study methods were designed to surface the experiences of family caregivers working in the academic sciences, engineering, and medicine whose perspectives have been

underrepresented in prior research. A qualitative approach was developed to allow space for the complexity (and often, emotion) surrounding subjective experiences of managing caregiving and career, the multilayered contexts in which those experiences occur, and their consequences for caregivers and the field at large (Sofaer, 1999). The study research protocol and all outreach and data collection materials were reviewed by the National Academies' Institutional Review Board.

Sampling

To ensure substantial representation of women of color and caregivers of intersecting marginalized identities, CWSEM staff, study committee members, and the RTI study team partnered to develop a targeted outreach campaign for the study. RTI and CWSEM staff focused on identifying and connecting with member listservs and similar communication tools that centered scholars of color; first-generation college graduates; immigrant scholars; those who identified as lesbian, gay, bisexual, transgender, or queer (LGBTQ+); and those living with disabilities.

Respondents were reached via a series of general and targeted outreach emails and via forwarding to individual contacts. Outreach messages described study eligibility criteria, interviewing approach, and compensation and directed interested individuals to a web-based screening form for the study.

The web-based screening form, developed and hosted by RTI, consisted of a set of closed-ended questions designed to establish study eligibility and elicit information on other relevant life experiences for case selection purposes. To be eligible, respondents had to be working or studying in academic science, engineering, and medical fields (including doctors and nurses in training or academic medicine) and must have had regular, unpaid caregiving responsibilities during or beyond the early COVID-19 pandemic. The screening form appears as Appendix A.

RTI reviewed incoming responses daily to identify eligible individuals and select a purposeful sample from among them. Based on the committee's assessment of perspectives that were lacking in prior research, priority was accorded to women and other caregivers of color as well as those who are LGBTQ+, first generation, immigrant, and/or living with disabilities. RTI also sampled for diversity in the following:

- Career path and stage, with the aim of including individuals at all career stages, on and off the tenure track, and with special priority given to women of color in senior faculty roles
- The nature of the unpaid caregiving responsibilities, including for whom care was given and what kinds of activities the caregiver performed

- STEM (science, technology, engineering, mathematics, and medicine) discipline, to ensure participation from subfields identified by the study committee as more heavily male-dominated¹

Outreach, screening, sampling, and recruitment proceeded iteratively based on the evolving characteristics of the available sample. RTI extended the recruitment period by approximately 1 month in order to support ongoing efforts to engage women of color senior faculty.

Data Collection

Individuals selected for interviews were contacted using each of their preferred modes of contact (email, phone, or both) and invited to schedule a Zoom interview with an experienced qualitative interviewer. Individuals who completed the screening form but were not selected to participate in an interview were thanked immediately and were notified at the end of the recruitment period, using their preferred mode of contact, that they had not been selected.

An informed consent process was administered at the beginning of each scheduled Zoom interview, and only individuals who consented to participate in the interview and to be recorded were interviewed. Interviews lasted approximately 1 hour and followed a semistructured guide that covered the following topics:

- Experiences of managing career and caregiving responsibilities simultaneously
- The macro-, meso- and micro-level contexts in which caregivers managed those demands
- Ideas for reimagining success and productivity
- Experiences of joy and satisfaction in career and caregiving

The interview guide appears as Appendix B. Following the interview, each respondent was sent a thank-you email that included a \$75 Amazon gift code, information about the expected release of study findings, and contact information for the CWSEM representative.

Analysis

¹ The “heavily male-dominated fields” identified by the study committee were physics; computer science; astronomy or astrophysics; and civil, aerospace, electrical, and mechanical engineering.

Interview recordings were professionally transcribed for analysis. A deductive codebook was developed based on the study research questions and early study committee guidance. Inductive codes were developed jointly by the research team to reflect themes that emerged during the interviews. New inductive codes were added by all members of the research team during the analytic process. The codebook appears as Appendix C.

In addition, a set of family codes was developed to reflect differences in life experience that the study committee expected might be meaningful for purposes of managing caregiving and career, including the nature of the respondent's caregiving role(s), the forms of care they provided, career path and stage, ethnic and racial identity, and other experiences of structural disadvantage (identifying as LGBTQ+, an immigrant, a first-generation college graduate, and/or living with a disability).

Recognizing the multitude of distinct life experiences of potential relevance and the complex, intersecting nature of those experiences, the team did not attempt to sort or otherwise "bin" the transcripts according to the family codes (as in a structured, comparative analysis). Rather, analysts referred to screening data to apply family codes to each set of interview notes at the beginning of the transcript review. This information informed the coding and theming process, and analysts made note of any inductive observations related to the family codes.

Themes were described in brief analytic memos shared across the analysis team via a shared master analytic file along with the exemplary quotations associated with each theme.

RESULTS

This section summarizes the study results. Results are framed with a description of sample characteristics, which offers a sense of the intersecting life experiences represented in the study sample. With a focus on caregivers of color and those with intersecting marginalized identities, who comprised most of the sample, we provide an overview of the caregiving and work-life management challenges participants faced. Despite the many strategies they employed to rise to the challenges that career and caregiving presented, respondents experienced substantial consequences from these challenges; therefore, this section also considers the professional and human consequences of unresolved conflict between caregiving and career demands.

Next, we examine how macro-, meso-, and micro-level factors, respectively, shaped caregiving experiences, challenges, and access to work-life supports, and we present caregivers' perspectives on improving work-life supports in academic STEM fields.

Finally, this section discusses the ways that caregiving enriches the personal and professional lives of STEM scholars and the alternative visions that such scholars advance for academic success and care-centered academic STEM workplaces.

Sample Characteristics

Reflecting the study aims and sampling objectives, a majority of interview participants were caregivers of color (N=26). Roughly one quarter of the sample identified as Black (N=9), Latinx (N=11), or Asian (N=10); half identified as White (N=21); and smaller numbers identified as American Indian or Alaska Native (N=3), and/or Native Hawaiian or other Pacific Islander (N=2).²

Women of color senior faculty (N=8), caregivers working in heavily male-dominated fields (N=4), LGBTQ+ caregivers (N=4), and caregivers with disabilities (N=7) were represented in smaller but substantial numbers. They were drawn from across all career stages, from students to senior faculty and academic leadership, with heaviest representation from graduate students, medical residents, and other early-career scholars. (See Figure 2.)

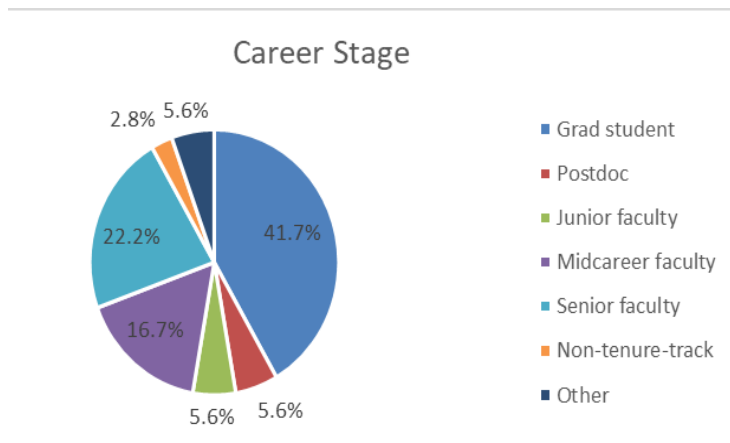


Figure 2. Career Stage of Respondents

Findings for Research Question 1: What shapes the ways that caregivers in academic STEM engage in and make meaning of caregiving, how they navigate work-life balance, and to what extent they access supportive policies and procedures?

Overview of Caregiving and Work-Life Management

A majority of qualitative interview participants were engaged in caregiving for young (35 percent) or school-age (38 percent) children. Substantial proportions, however, were caring for other loved ones: one-third were caring for a parent or other elder family member (33 percent), and smaller proportions caring for chosen family or friends (15 percent), spouses or partners (10

² The racial identity question allowed study participants to indicate one or more categories with which they identified; the resulting responses do not sum to 40.

percent), members of extended family (8 percent), or an adult child with disabilities or other intensive caregiving needs (8 percent).

Participants fulfilled a wide variety of caregiving roles, as shown in Figure 3 below. Most provided support with activities of daily living as well as a range of other high- and low-autonomy responsibilities.

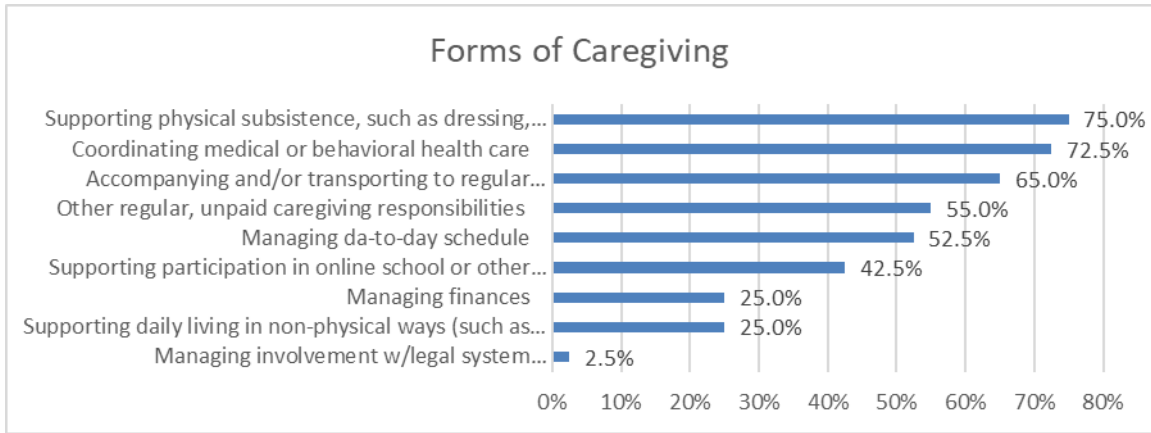


Figure 3. Forms of Caregiving

Study participants reported having made a range of career changes due to the imperatives of their caregiving responsibilities, as shown in Figure 4 below.

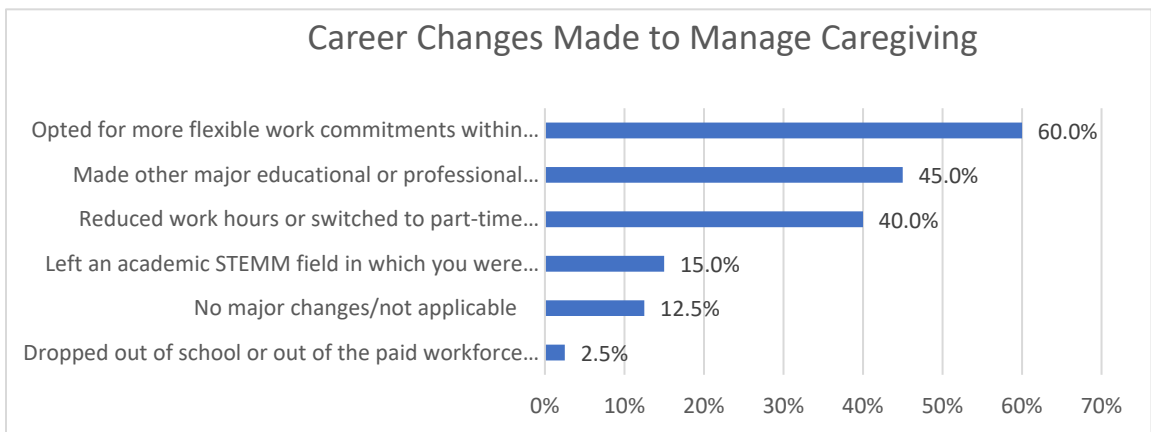


Figure 4. Career Changes Made to Manage Caregiving

The most common changes were opting for more flexible work commitments (60 percent), reducing work hours or switching to part-time status (40 percent), leaving the academic STEM field in which they had trained (15 percent), dropping out of school or the workforce entirely (3 percent), or making other major education or professional changes (45 percent). A small proportion (13 percent) of sample members had not made any major career changes due to their caregiving responsibilities.

Consequences of Conflicting Career-Caregiving Responsibilities

Caregivers expended tremendous intellectual, financial, and physical resources in the attempt to manage the competing demands of their careers and caregiving responsibilities.

Interview participants described distilling their priorities and triaged their workloads; devising new time-efficiency strategies; learning to fit more flexible work and caregiving commitments in around inflexible ones; communicating proactively with advisors, teachers, managers, and academic leadership; and developing a host of creative personal and professional arrangements to attempt to fulfill their competing academic and professional responsibilities. Such strategies were often a source of pride, and some success.

Still, most interviewees—even those occupying positions of relative personal or professional privilege—experienced the conflict between their careers and their caregiving responsibilities as irreconcilable.

In a perfect world, I could balance it all. I could just be really efficient at work, get through my calls, get through my notes, then come home and have dedicated time to spend with caring for my mom. But the time just doesn't allow for it. There's often times where I'm staying late trying to catch up ... it just squeezes how much care I can do.... You can't be great at either [career or caregiving] at the same time.

It's like a mental toll ... there was definitely a lot of, you know, questioning my decisions and, you know, feeling like I was pulled in multiple directions ... I was probably giving like 50 percent as a mom, 50 as a daughter, 50 as an academic, and, you know, it seemed like nobody was happy ... myself included.

I don't know that I was ever able to make that balance work ... there's no balance. It's just progressively gotten worse over time. You know, there are some days, if you look at it on a day-to-day basis, you know, some days don't feel so bad. And some are just awful.

Caregivers viewed these consequences as sharply (and unfairly) curtailing their scientific and professional contributions. They also recounted immense human costs. Letting go of basic human needs—particularly sleep and medical care—was common. Interviewees also shared stress, exhaustion, and mental health challenges from depression, anxiety, and “burnout” to “many panic attacks, many mental breakdowns and meltdowns.”

Stress. Stress. Lots and lots of stress. Sometimes depression when you feel like you can't get it all done. You feel like you're failing. You've got all these

responsibilities, and you're like, I can't do everything. But I have to, because if I don't, who's going to?

Many interviewees also shared deep emotional pain and anguish, particularly when they let go of some aspect of their responsibilities in order to fulfill another. As one caregiver explained about shortchanging caregiving activities because of work obligations, "It really gets emotional, because you have to forego some of the very important things in life."

One of the biggest consequences is that it has hammered away at my sense of well-being. I carry a lot of guilt for the things I haven't managed to do for my kids or the things I haven't managed to do for the people in my lab. I feel like a lot of times I'm doing two different caregiving jobs. I've got my family caregiving and then I've got my student caregiving. And I would say both sides feel like they're not getting enough and there's just me."

Caregivers' professional responsibilities also had very real, human consequences for those they loved—particularly times that elders or young children were left alone in painful, dangerous, or frightening situations while their caregivers attended to professional responsibilities.

She did have a very, very bad experience where I went away for a conference and as soon as I left, the very day that I left, she fell. And at that point she did not have a first alert ... it was one of those nightmares where she was on the floor for several days before I figured out, having called her over and over again and not being able to get through to her, that something was wrong. I had the neighbors go over there. They finally got the fire department to get in there and rescue her. But of course, she was scarred from that.

Many caregivers opted to conceal the serious personal ramifications of career-caregiving conflict from their supervisors and colleagues. Those who did share honestly—particularly those who were minoritized or otherwise vulnerably situated in their labs and workplaces—sometimes regretted doing so. As one graduate student (who identified as a queer Black immigrant woman) explained,

I talked to my academic advisor and he encouraged me to talk to my instructor of my specific course. I talked to him about [how caregiving] is really affecting my academic performance ... and he kind of was dismissive of the fact that I had just told him about something very traumatic that happened to me, and I was literally crying in front of this man, and I regretted it immediately because he didn't give two sh-ts. He was just like, "Okay?" [and] it just made me feel uncomfortable and I shouldn't have said anything.... I realized in that moment, I have to be careful what I share with people and who I share with.

Micro-Level Influences

Caregivers identified a number of micro-level factors that influenced their experiences of work-life management, including household structure and the nature of their caregiving and professional roles.³

Household structure was often noted as making it easier or more difficult to balance caregiving with academic STEM responsibilities. Caregivers who had adult domestic partners often noted that having another person living in the home who could share caregiving labor was very helpful—even when the focal caregiver retained primary responsibility. Caregivers who were unpartnered noted that the absence of another adult in the domestic sphere made things more difficult.

I don't know how many in your study are single, but this is another factor for those of us who are single caregivers. So, I didn't have a husband or a brother or sister, or someone else who was living in our home to look after her. So that's, I think, a huge consideration as well.

Nevertheless, caregivers with domestic partners who were heavily involved in caregiving often noted that this supportive presence did not come close to alleviating the strain of career-caregiving conflict.

I have two young children, and a very supportive and involved spouse, and it's still a struggle. And I think the demands of children, especially young children, are there. There is no flexibility there, because they just need everything that they need, and so, no, there is no flexibility there. Which is, I think, a function of their age. And so, you know, even if I'm not physically doing childcare, I'm cognitively doing childcare, as is my spouse, during working hours.

Caregivers also noted that the nature of their professional and caregiving responsibilities shaped the relative ease or difficulty of work-life management. Those who had relatively low flexibility in their caregiving (such as those who were responsible for day-to-day subsistence activities) and in their professional lives (such as students, junior scholars, and those who worked in laboratories or clinical settings) found it especially hard to manage the two roles simultaneously.

I'd say [I have]] relatively little control, just because things happen ... I've got three kids [who are 5 and under] and then the elderly parents.... As much as we tried to set a schedule, you know, we joke about how like, someone's always sick. So, you know, whether it means that they can't go to day care from the child

³ In general, micro-level factors identified by qualitative interview participants were nonnovel (that is, they have been amply discussed in other caregiving literature) and/or nonmalleable (that is, they were unlikely to be influenced by the kinds of changes in STEM workplace climate or institutional policies and practices on which the study committee is focused). As such, these factors are not covered in exhaustive detail here.

perspective, or even the adult perspective, because we send my father to a memory care day care.

Many academic STEM students and faculty had roles that demanded more time-inflexible and on-location activities, such as working in laboratories or providing clinical care. These interviewees recounted particular stress and strain at the lack of available flexibility or the infeasibility of taking advantage of such accommodations.

Maybe if I could have altered the structure of my workday, where maybe I had maybe a few less clinical sessions and altered it with maybe teaching or being able to do more research [that] could be more flexible because I could do that from home.

A lack of role- or task-based flexibility was cited as especially impactful among caregivers who faced structural disadvantage outside the workplace.

If I can't make it to class because I have to stay at home, can I remote in and view it via video? Can the lectures be recorded so that I can watch them later? Can I set up a Zoom chat with my professor because I don't have gas money, I don't have a way to get to his office hours at this particular time? Just taking advantage of some of the technology, making it a little bit easier for us, especially parents of color. Because I feel like, as sad as it sounds, we tend to not be financially as well off as some of the other parents just because of some of the things in place that are out of our control.

Caregivers in less-advantaged personal circumstances or from less-advantaged backgrounds were less likely to be able to deploy financial resources to soften the impact of inflexibility in the academic environment (see also "Macro-Level Influences").

Meso-Level Influences

A number of meso-level factors mitigated the potential helpfulness of supportive policies maintained by funders or academic institutions. In particular, caregivers noted that many STEM departments and workplaces still operated on unstated, antiquated assumptions about STEM professionals' family structure and (lack of) family responsibilities that put caregivers at tremendous disadvantage.

I think the biggest thing about that in particular is that I work in an environment that's mostly men. Several of those men have or had stay-at-home wives, or wives that had much smaller job responsibilities, maybe part-time. And so there's kind of this expectation that we're just going to figure it out, and if this meeting that's going until 5:00 runs over, that's just what it is.

In this context, there was often a lack of information dissemination to caregivers and a lack of support among mid-level academic leaders for understanding and accessing the supports to which caregivers were entitled.

I definitely think this is the institution's culture, that it's basically for you to figure out. I know of other universities and programs where there is open conversation about it or open support and dynamic negotiating of balancing life with work. [Redacted university] is very much of a sink-or-swim place. Either you figure your sh-t out and show up to work or you go somewhere else, and it's pervasive. I think everyone feels that way and it's also very, very present ... people will openly talk about like, Oh, this person shot to the top because they have a stay-at-home wife. The only vice chair that's a woman has never been married and has no kids. It's sort of this common, unspoken curriculum that either you figure it out or you don't have the constraints, but nobody's going to help you figure it out or support you.

Students and other early-career scholars reported great difficulty accessing even basic caregiving supports, such as postdelivery recovery time and parental leave or tenure clock adjustments. Students, in particular, often did not know what they were entitled to or were reluctant to ask.

I've spoken with other people who had children earlier on [in their careers] and I think most of them, in my experience, had to navigate it themselves.... I just think there needs to be some kind of standard for that from like a normal recovery standpoint. [I was] back in class 2 days after I had my daughter, and I was like breastfeeding her on Zoom.... I was in class like, you know, the day that I delivered.... Those were personal choices on my part, but they were things that I felt like I needed to do in order to stay competitive and not be labeled as like, Oh, she's a mom.

Hesitation to access formal supports was not limited to students, however. In some academic STEM workplaces, caregivers perceived an implicit message that discouraged use of available work-life supports, including more quotidian ones like paid time off.

I'd say leadership.... Okay, I'd say fear of stigma and discrimination ... some people may be fearful of utilizing the work-life support policies that are put in place because such expressing a need for work-life balance could lead to negative career consequences.... Also, there is the workload and time constraints where very heavy workloads and also time constraints can make it challenging for us to take advantage of work-life support policies. Maybe you have very high demands, you have tight schedules and tight deadlines, so it's very rare for you to even ask for a day off.

Because of these issues, it was not unusual for caregivers to learn of available formal supports after the point at which it would have been helpful to access them:

I think definitely having a conversation about the tenure clock ... having someone advise on what would the options that were available to me, I think that would've probably shaped some of my work.

Others did not always receive the accommodations to which they should have been entitled, even when they did ask.

I had a medical student come to me and say, “I just went and talked to the dean of admissions to tell them I was having a baby and to ask for parental leave. And he told me that I could have 3 days off, and if I needed more than 3 days off, I would have to repeat the year of medical school.” Can you imagine? And that was, like, 6 years ago....

My own first child, I took 4 weeks of leave, and for that 4 weeks of leave, my department required me to work for half pay for a year. That was incredibly difficult. And it was not the worst parental leave experience that I’ve heard from a faculty member.

Formal supports were even harder to access for nonfaculty, including graduate students, postdoctoral fellows, and trainees.

It’s super tough if you’re not faculty to get the privilege of affordable childcare. There is a barrier, and the institution would say, “We just can’t provide it for everybody, and there’s always a 2-year waiting list.” [But] having access to affordable care would go a long way for a lot of junior faculty and even graduate students or postdoctoral fellows.

In addition, those caring for loved ones other than young children noted that their interactions with leadership and colleagues often reflected a lack of understanding of the nature of caregiving for elders and loved ones with disabilities.

Many institutions have a childcare benefit that allows you to place your child in day care, or they have a day care themselves, or they have some childcare benefit. I’m finding it difficult to find eldercare benefits. So, it becomes really challenging.

Some available policies may not have applied to those caring for loved ones other than minor children, but in many cases, administrators were not sufficiently knowledgeable about what was available or permissible to offer, or be helpful when approached for, assistance. For example, a graduate student who left academic STEM due to the financial pressures she faced as a caregiver for her grandmother recounted,

With the additional stipend I think it was like [whether] you have dependents. I think the real stymie with that one was ... not understanding whether or not they had to be my dependent on federal taxes or something like that. And the person who was in charge of dealing with that also didn’t know the answer to that and they just weren’t really all that informed on their own policies because it didn’t come up that often.

Those who were caring for elders or loved ones with disabilities also felt that interactions with colleagues and supervisors (even, or sometimes especially, those who were caregiving for minor children) reflected a lack of comprehension of the unique demands that other forms of caregiving could present.

I try not to get into it too much with these academic people because I know they do not understand what a sponge bath is. There's no way that my research advisor knows what a freaking sponge bath is, but I was just like, "I got stuff to do. I have responsibilities at home." And he's like, "We all have responsibilities at home. That's why my kids are on campus sometimes." And I'm like, "Yeah, I don't have children and the person that I care for basically can't get out of bed for more than a few minutes at a time. So, no, I can't bring my family here so that they can eat dinner and take a sponge bath and take care of their hygiene needs."

Yet caregivers reported many helpful meso-level influences as well, particularly the presence of supportive peers, supervisors, and mentors in their academic workplaces. They noted that being able to compare notes with colleagues who were also caregivers was a helpful antidote to department norms that sometimes felt alienating.

I have a couple of colleagues [who] have been really helpful, in terms of just either helping with the actual work or just helping to talk through the issues at hand.... I feel a little bit like I'm being gaslighted. The world around me lives in a very specific place, and I'm just like, "This place feels crazy. This is not a reasonable response to this." And knowing that it's not just me has been tremendously helpful to just keep managing.

Those who had friends in the workplace could often draw on them for a combination of emotional and practical support that alleviated some of the challenges they faced with career-caregiving conflict.

I had a colleague. He was my best friend [and he was] supportive, and at most times trying to help me with my assignments. Because he understood ... the responsibility that I had and was always encouraging me to keep moving forward, no matter how hard it was to jump between my worlds.

Other caregivers described how a generally supportive and collegial atmosphere in their departments, characterized by ongoing give-and-take relationships in which colleagues regularly stepped in to help one another, made it easier to address unexpected caregiving demands without serious professional consequences.

It's always easy to communicate with someone to take up a shift for you or do something really, really quick at the office, if you're not able to tend to it.... They support you.

Engineers occasionally noted that the "outcome-focused" culture of engineering could be an asset to caregivers in academic engineering workplaces.

The focus [is] on outcomes and not just time commitment. Getting things done and done well is what they expect. Not just being seen online for 8 hours straight. In engineering, people are very outcome based. They're interested in having goals and metrics met as opposed to hours spent on a task.

Many interviewees noted that having a combination of peer connections and mentorship from more senior colleagues who had navigated similar challenges was a tremendous source of comfort and also of practical knowledge.

I think it's very helpful to have people who are navigating the same thing, [and] what has [also] been helpful is having senior women who are, you know, some years advanced in terms of their career stage [and] who recognize the extent of caregiving. I think those two things are really helpful, peer support and leadership or mentor support.

Indeed, caregivers who had supportive managers, supervisors, or academic leadership noted that such figures made it much easier to manage their caregiving and careers simultaneously.

My department administrator first and my faculty in the department. They all have been very supportive and understanding that I'm not there physically all the time. I meet with them a lot by Zoom, but they have an understanding of that. And they have been the most important humans outside my home helping me keep going.

I had a boss that was incredible, multiple bosses who were incredible. But in that 5-year period that you're asking about, I was fortunate to have a dean who I reported to, who was also taking care of elderly parents at the time and understood the complexities, and so was just very understanding.... I don't know, if I had a doctor's appointment or something like that. I think that I didn't specifically have institutional policies, but I had an institutional leadership that was helpful.

Interviewees regularly noted that it was helpful when clinical, lab, or academic leaders had personal experience with intensive caregiving.

I think the only reason I had that [partial flexibility was] because ... the team that I worked with was overseen by someone that also had caregiving responsibilities and she, herself, knew the pressure that I was under.

But others noted that managers who didn't have similar caregiving experiences had nevertheless been caring and effective supports.

My chief has actually been really great. So, there were some times, for instance, when my mom needed surgery and he had worked with me to gain the coverage that I would need to be out for several weeks. Also, when my mom initially had a stroke, he was able to step in and cover for me and allow for me to be able to go through the process of being out on FMLA [Family and Medical Leave Act] seamlessly, without making me feel guilty. He just encouraged me to take the time I needed to take care of her.

Whatever their personal experience, it was clear that many academic STEM leaders made a tremendous difference for caregivers in their labs and departments simply by being aware of

their work-life management efforts and knowledgeable and communicative about available institutional supports.

They have been very understanding and have implemented, appropriately and correctly, the policies of the campus to support these kinds of responsibilities. I have felt very supported.

Macro-Level Influences

Macro-level influences featured prominently in caregivers' assessments of factors that had shaped their experiences of work-life management. They highlighted the profound impact of the COVID-19 pandemic, mainstream U.S. culture, structural racism, and gender norms on their efforts to manage career and caregiving demands.

Interview participants spoke appreciatively about formal supports implemented in the context of the early COVID-19 pandemic, including the following:

- Remote learning options for students during COVID-19
- Adaptations in short-term disability policy to include up to 90 days' leave for COVID-19
- Extensions of grant funding for caregivers and others affected by COVID-19
- Grant and tenure evaluation provisions to account for lapses in publication or other productivity due to caregiving responsibilities during COVID-19
- University grants to offset caregiving responsibilities in the context of COVID-19

As one faculty member explained, such supports were not only of practical value; they sent a powerful and often unprecedented official message that the challenges caregivers faced were real and addressing them was a sincere priority.

Extra grant support for people who feel behind during COVID[-19], that has been very helpful....It tells you that somebody else recognizes the impact of that event on resources. And I think that is really important, because the message that the funding body is giving is, we recognize it's a problem and look here, we're addressing it.

Similarly, interviewees who had received small, flexible grants to offset caregiving-related expenses (such as those provided by the Doris Duke Foundation) found them both validating and greatly helpful.

“It was almost like ... we know that this is hard, and we recognize it and, here is money towards it.... So, I was like, Okay, here's dedicated money that I can use

to make my life easier. So, I feel like that was extremely helpful ... just that permission to say, Okay, I can do this.

Most caregivers also appreciated flexible work arrangements, including flexible work hours and the option to work remotely. Caregivers of elderly parents or of loved ones with intensive physical care needs, in particular, noted what a relief it was to be nearby and available when their loved ones needed them.

One thing that I've also benefited from is, I'd say, flexible work arrangements where institutions offer very, very flexible work options, flexible work hours, compressed work weeks, part-time work, and also as we've said earlier, remote work. These arrangements allow us as employees to balance work and also now the personal responsibilities.

Many expressed frustration and concern about the disappearance of some early-COVID-19 accommodations from academic STEM workplaces.

It's basically gone. It's now like COVID never happened, and everybody has forgotten about it. [But] there's a vast amount of data saying women were affected on basically every academic metric. And I have yet to see how this is being addressed.

Such accommodations remained relevant and needed by many, and their retraction often reinforced an impression that academic institutions did not recognize the extent of the challenges that caregivers faced even under ordinary (non-early-pandemic) circumstances.

For caregivers of color and those from immigrant families (who comprised the majority of the interview sample), navigating the dominant cultural values reflected in U.S. academic STEM presented particular challenges. Managing career and caregiving demands simultaneously was not just a matter of navigating conflicting individual priorities; they were faced with a fundamental conflict between the family-centered, communitarian values they had internalized from their families and communities of origin and what they saw as the (less desirable) U.S. mainstream cultural values reflected in STEM workplaces.

My parents taught us to love one another and also to be responsible for the people around us, especially the family members or the people who could not take care of themselves, people who are sick.

[What about dominant culture messages?]

I'm not that type of person. What matters to me is what I think is right, and what I think is right is taking care of the people around me.

Indeed, caregivers often chafed at the implicit assumption that they should leave behind the cultural assets of their own families and communities in order to succeed in the more individualistic and competitive environments they encountered in academic STEM. Interviewees in this position often took great pains to emphasize that no matter how much they prized their

academic careers, “family comes first”; if their workplaces could not accommodate their caregiving responsibilities, they would leave academic STEM before they would abdicate caregiving.

It’s very typical and in keeping with my culture to take care of your elders. And so, I always knew that this responsibility was going to fall on me. I had learned of [my mother’s] diagnosis, and I knew then that I was no longer going to be able to pursue the career that I wanted. [After my mother died], taking on my grandmother was not a question of like, do I want to? It was just, like, it’s a natural thing.... Obviously, I’m aware that, like, white culture isn’t like that [but for me] it’s, like, what was expected and what’s normal.

Those who had family working in academic STEM outside the United States (a not-uncommon experience in the study sample) felt that the academic climate in U.S. STEM fields compared very unfavorably to the academic STEM climate in other countries.

It’s very different than it is here in the U.S. We [in the U.S.] have very much like a grind culture. Over there ... they have a year off for maternity leave and here I was expected to be back at least part-time 8 weeks postpartum.... It’s not like I could just say, I’m not going to answer anything for the next 8 to 12 weeks. I always had to be on email.... I think that’s very much not the case in other areas of the world where they really try to protect moms and new parents.

Broader systems of advantage and disadvantage by race, gender, and class also heavily shaped caregivers’ ability to manage conflicting career-caregiving demands. Caregivers suggested that these systems of privilege simultaneously influenced the (structural and interpersonal) likelihood that a STEM scholar would be faced with intensive caregiving conflict as well as the extent of guidance or institutional support they might receive in facing such conflict.

“The structural issues that exist are, either your privilege gives you the space to be able to meet the standards and expectations that have been institutionally inherited for years—that really only are conducive to a white man who has a wife at home, so it’s easiest for them to achieve those—or the people who get the strategic advice and guidance are receiving it because they have some sort of social connection to the people who are in the know. So, the social similarities, sort of like, in a way, some elements of nepotism, like well, I’m really good friends with the white man in power, therefore they help guide me, but no one else is getting that guidance.

Further, caregivers with access to substantial private resources, such as individuals in academic leadership roles or those in dual-career physician couples, recounted using every financial resource at their disposal to make their professional situation tenable in the context of substantial caregiving commitments.

The only way I was able to make it work was my husband was a stay-at-home dad at that point.... He’d get up in the middle of the night with changing my parents’

bedclothes if there were accidents and things like that.... The only way we were able to make that work was him being at home. And I think that's a real problem because not everybody has that flexibility. I probably would've had to put my parents in a nursing home if it wasn't for that [or] I would've had to quit my job ... the combination of financial resources and partner resources helped me to care for kids and parents at the same time.... I wouldn't have survived without that.

Those who had fewer private resources, particularly students and other early-career scholars and those from underrepresented backgrounds, recounted substantially more difficulty (and steeper consequences) from navigating career-caregiving conflict. It was not unusual for such scholars to recount being driven out of their scientific careers, or out of academia, entirely.

Not everybody comes from a privileged background. So those expectations that you have to work for these high-risk, high-reward projects for many years and put the rest of your life on hold, they are nonsustainable for most of us, right? And especially if you have a young family. I mean, you can decide to sacrifice your time and yourself, but you cannot do that for your family.

Caregivers of color also relayed how, in the context of longstanding structural racism and exclusion in their institutions and disciplines, it seemed that they were expected to fail when negotiating conflicting career-caregiving demands.

From a more, like, systemic discrimination aspect, I felt [that] my institution was just, like, kind of waiting for me to fail.... I was juggling a lot of things, and they were just waiting for me to, like, drop everything.... They highlighted the times that I didn't meet expectations a lot more than, like, all the other times that I did, or that I did publish, or that, you know, I did do extremely well ... it was just interesting how often they were quick to say, like, Oh, it's because she's got kids. They're like, Oh, it's because she had kids during the program, or it's Oh, it's because her dad's, you know, sick. So, I felt like ... they used it against me.

Caregivers of color echoed the idea that a combination of structural and interpersonal racism put them at a disadvantage in the interpersonal communications and negotiations that career-caregiving conflict necessitated.

I did face some form of racism, and that was from my department coordinator. He was quite biased between students of Black color and white students when you couldn't attend to your needs and maybe went to the office with an issue.... The Black students would be attended to after the white students had been attended to, and it was quite demoralizing. It did affect my morale ... in terms of class and how I was relating to assignments and to projects, it affected my morale and I was, like, Maybe I can stop doing this and just leave this and go. It's quite hard to express what I felt at that moment. It was a hard time for me. Racial discrimination really takes away from you and how you perform your duties.

Faced with the dual adversities of career-caregiving conflict and structural disadvantage, and with limited private resources to cushion the strains, some scholars (particularly early-career caregivers of color) seriously considered relinquishing their STEM careers altogether.

Findings for Research Question 2: What alternative structures, standards, norms, and supports might better promote work-life balance for caregivers in academic STEM, particularly caregivers of color?

Improving Work-Life Supports in Academic STEM

Globally, interviewees shared the perception that the scope and nature of available supports was grossly out of sync with the enormity and complexity of the challenges that caregivers faced in balancing academic STEM careers and caregiving responsibilities.

I think policies that have not been helpful has just been a general lack of understanding of what [balancing caregiving and academic medicine] takes. I think it was never there, but it was jarring to have it called out during COVID.... I speak to a lot of people from other institutions, and it sounds about the same. So, this is just a reflection of our academic culture.

In addition, many caregivers assessed the specific formal supports that were available in their workplaces as unhelpful.

The university is really proud of the fact that they have this relationship with a company ... that's supposed to help you find care, and so if something comes up and you've got a kid that's sick, they're supposed to be able to find you a last-minute babysitter so you can still get to your work activities and your kid can be taken care of. They love this idea. I don't think they've really understood that, especially if your kid is small and ill, you're not going to leave them with a stranger.... It's a bizarre policy in some ways. And [when] I have called them...they can never find me a caregiver that can take care of a special needs kid. So those of us with kids with autism or developmental issues or behavioral issues or severe ADHD [attention deficit hyperactivity disorder], we can't use that program anyway.... People think they're helping, but they're not really helping.

Indeed, the inadequacy, inaccessibility, or effective unavailability of institutional childcare supports was a subject of widespread critique among the study sample—perhaps because interviewees so desperately needed these services.

I know it's a really good daycare center, but it has a waiting list 6 years in advance. So, you essentially have to know before you get pregnant that you're going to use this service, and it costs a lot of money.

Further, interviewees sometimes chafed at employer offerings of immaterial self-care or wellness resources (e.g., apps or newsletters) when unaccompanied by more concrete forms of assistance.

I feel like sometimes the resources that are intended to promote well-being are just ... extra things to do. So, I feel like it's more convenient when you're empowered to really voice your concerns and also be listened [to] instead of doing something extra to handle your stress. So, I think if the stress is coming from work, then what it needs to be done is to readjust the goals or to try to find out where is the problem instead of giving you maybe a meditation app for your phone or things like that. To me, that's a little bit of a joke in the sense that you barely have time, so then you don't want to dedicate your time to do those [wellness activity] things.

Although sometimes the disconnect was a matter of scale—that is, interviewees perceived the formal supports offered as trivial relative to their tremendous need—others suggested that simply asking caregivers what would be helpful might yield guidance on simple, inexpensive gestures that met real need.

You assume that people want to exercise in the hospital, you assume that maybe people want apps in their phone, but it's not really asking what you need or what you think is helpful or what you will appreciate more.... If the hospital wants to do something for you, they can give you food, ready-to-serve meals ... everybody's happier when they have food and you don't have to cook. Maybe nobody has asked people.

But many who succeeded in accessing formal supports, particularly time off and assistance with childcare or other dependent care, found them quite helpful. For example, caregivers who took paid FMLA leave or other forms of employer-paid leave found this paid caregiving leave time incredibly valuable.

The FMLA policy ... I don't utilize it often, but for the two acute major events that occurred, I was able to utilize them, just [to] have time just completely away from work to be able to focus on caring for my mom. So that's probably the biggest thing. They do also have wellness days, for instance, where these are outside of PTO [paid time off], where you can take a couple of days to care for yourself or someone that you are caring for. That's about 4 days a year. So, it's really mostly that, about the time off, that has been helpful.

Though less commonly cited than paid leave, dependent care flexible spending accounts were also mentioned as a helpful support. Such accounts offered a meaningful financial break with the cost of care, which was a major “pain point” for many interviewees.

It's been wildly helpful because actually that's allowed me to use childcare twice a month—otherwise, I wouldn't—because I can get reimbursed for it. It's also helped with the summers, because my schedule hasn't changed and camps are expensive; it's helped subsidize camp.

Caregivers also shared a multitude of ideas for formal supports that did not exist at their institutions but that would be (or would have been) helpful. Chief among these were supports that addressed scarcities of time and money.

I think what caregivers need more than anything is time. We lose time. Anything that helps caregivers preserve time in terms of, like I said, policies that help you get rid of things that you don't necessarily have to do. Even a stipend that lets you get someone to do your laundry ... unless you just love doing laundry, let someone else do it. But all these things take money, too. So, it's time and money.

As one early-career scholar put it, "I think that support that I needed from outside of just me would definitely have been financial." Help paying for childcare, in-home eldercare, and other forms of paid caregiving services similarly topped many interviewees' lists of desired supports.

I know there are some states where if you're taking on caregiving responsibilities, there can be some governmental assistance. And I think people who don't have a salary that can help them provide that care, it's really important to think about what systems we can put into place for them. So, somebody with a lower salary, are there either work-related, employer-related, or government-related supports that can help them to keep family members at home? Day care is another example. Day care is incredibly expensive. How do we make sure that we have those resources available for people? I had the day care and the eldercare, and it was really my salary that was going to support that, but they were all in the home. Financial resources.

Interviewees often suggested the idea of a flexible stipend for caregivers that could be allocated at the caregiver's discretion.

I think if [redacted university] really wanted to help, with a very minimal amount of money, they should give all of us a budget that says, You can use this amount of money per month to do whatever it is that makes your life easier, whether it's pay for your laundry or deliver groceries or have a virtual assistant, or have a coach that helps you keep yourself on track each week. That would be the easiest way to make all of our lives simpler and easier, probably with less money than they're putting into some of the programs that aren't useful.

Interview participants also suggested that additional paid time off, or even unpaid time off from academic obligations (for full-time students), would make managing caregiving and career demands easier.

There needs to be these built-in pockets of, for someone that's caregiving; there needs to be a flexible schedule or pockets where, Okay, we understand that you're a caregiver, so every few months, every 2 months, we're going to give you some time off to deal with family.

Yet interviewees urged that funder and university policies on time off had to be brought into alignment to be usable for caregivers. They highlighted instances where a lack of such alignment

between their primary funding institutions and their home academic institutions kept them from being able to take advantage of a policy that might have otherwise been helpful.

It's great for funding agencies to say you can come back after maternity and work part-time. But I mean, my institution is not going to allow that. So there has to be some way to resolve this ... if the stated goal is inclusivity, it will not be achieved in the system that we have.

Caregivers stressed the need for additional institutional support that would promote and cultivate forms of social support in professional and scientific settings.

At times, we [caregivers] miss a lot in the office, and at times we also, you know, miss the opportunity to actually have the opportunity to find or relate to other people who are in the same place, and make connections really, connections that get us through, that enhance our productivity as people who are career oriented and also doing caregiving work. I'd say that one thing ... they should put into consideration and really invest in is a mentorship support.

Suggestions included greater support for mentorship from individuals who had managed, or were managing, similar caregiving roles on a similar career path.

Developing some mentorship programs where you can pair caregivers with mentors who have successfully navigated similar challenges in their caregiving. And then providing some guidance and support for professional advisement while balancing also the caregiving responsibilities.

If a program like that existed where, you know, at the institution that I was at, if they asked me, like, would you be willing to mentor, like, mothers who are in academia or daughters with, you know, aging parents ... I think I'd be happy to step up and be, like, Yeah, sure, I can offer at least my experience, and you know try to navigate or, like, you know, tell them how I did it.'

Others proposed affinity groups or organizations that could foster lateral connections among caregivers in STEM. Scholars who had felt effectively shut out of networking opportunities in their departments, universities, or broader scientific communities due to their inability to travel to conferences or attend evening social events also expressed a need for professional networking opportunities that could be accessed without travel or undue time away from home.

Maybe there could be something separate for caregivers in STEM. So, I thought that was really cool that I even saw this flyer or in my email about this because I'm like, There must be more people experiencing this and how do they deal with this? How do they balance everything? So, maybe even having a support group on campus, and then also just maybe even sending me a resource or pointing me in a better direction to someone that might be able to better understand what I'm trying to say. And then coming back and saying, Okay, this is how we can really problem solve and fix what's going on.

They noted that such networking opportunities, within and across STEM fields, were crucial for being a part of early idea development and exchange within one's academic community.

Graduate students, particularly students of color, voiced the importance of housing and transportation support. Several early-career scholars articulated the long travel times from neighborhoods of color to university campuses as a serious equity issue.

Inherent in the problem that I face is the generational wealth gap ... the disadvantage [that] a history of racism has kind of given to Hispanics and Black African American [that's] created kind of just an environment that makes things more difficult. Just to give an example, for example, I live in a very poor part of the Bronx, so it's very far from my institution; travel's a burden for me which also makes other aspects of my caregiving very burdensome.... That's not necessarily the institution's fault, but that's more just a generational race-related problem ... to travel from [home] to my institution is about 2 hours.

For some, the feasibility (or relative infeasibility) of travel between their university campuses and their homes was a major factor in dropping out of, or considering dropping out of, advanced STEM training.

Other formal supports suggested by interview participants included the following:

- Training managers and supervisors in academic STEM about the seriousness and nature of caregiving challenges and strategies for supporting caregivers
- Offering affordable family health insurance policies for faculty, postdoctoral fellows, and students
- Developing more national professional groups focused on career-caregiving issues
- Providing university-sponsored caseworker or social worker assistance to help coordinate health care, connections to benefits, and other services for those caring for elders and family members with disabilities or chronic health conditions

Finally, caregivers of color repeatedly highlighted the central importance of robust institutional support for caregivers as a core equity issue.

Many cultures like my own—Hispanic, I believe African Americans, Native American—we are very committed to family. And many of us are now taking care of somebody in the family, especially when we start getting older.... An incredible recruitment tool to increase diversity and a sense of belonging to people from different cultures, health insurance or packages that will cover extended family members, that kind of support. I think that it will be more than the dollar amount of a startup to start research or even the salary. With something like that, I think institutions will be able to recruit the population of faculty and staff that they want to have to increase diversity. Not having [these] kinds of policies has been very difficult.

For institutions aiming to build equity in STEM scholarship, they argued, recognizing the cultural value of caregiving (and supporting STEM scholars in providing that care) was critical.

Alternative Visions of Academic Success

Caregivers put revised standards and process for tenure and post tenure advancement at the center of their alternative visions for the academic STEM workplace. Building on the idea of a “COVID statement” (implemented on some campuses for faculty who came up for advancement during the early pandemic), interviewees suggested institutionalizing a process for taking ongoing caregiving responsibilities into account in academic advancement decisions. Several interviewees proposed that all tenure and promotion packages should include a written statement on responsibilities outside of the university.

A packet for promotion, for tenure, for evaluation would contain a section that describes your outside responsibilities, your home responsibilities.... “Tell us about who you are outside of work and what other responsibilities you have.”

Interviewees envisioned a caregiving statement as detailing current (and relevant recent past) caregiving responsibilities, and perhaps other outside activities that conferred a sense of the candidate as a person with compelling investments and accomplishments beyond the academic workplace.

The timeline maybe wouldn’t need to be so rigid, or even the expectation of actual amounts of productivity, if you could take the opportunity to explain: This is what I did with my time. Despite the fact that I have X, Y, Z other responsibilities to take care of at home ... I was still able to manage to do this thing in this amount of time with what I have.

Caregivers raised fundamental challenges to the temporal structure of the tenure process. Many were aware of (and had been offered or received) additional time before the tenure review to accommodate their caregiving responsibilities. But they often argued instead for abolishing the tenure clock altogether.

If you had this [caregiving] life event, should that not be taken into consideration? So, instead of delaying the tenure promotion by another 2 years, which doesn’t help a person, could you put it in context?

Many caregivers stressed the importance of replacing “rigid” tenure timelines and guidelines with a more flexible, tailored assessment of a candidate’s academic talent and potential. They also advocated for a holistic tenure evaluation that accorded appropriate weight to contributions beyond publications and grants.

I have a colleague who has a fair number of papers, a fair number of grant dollars, but every single one of his Ph.D. students quits because his mentoring is atrocious. And he has tenure.... If we actually thought about the whole job and all

the pieces that came with it, that would be bad. That should be bad. But it's not. And I think that that means that the entire system that we're judged on is just fundamentally flawed.

For caregivers from underrepresented backgrounds (who comprised much of the interview sample), according explicit and substantial value to teaching, mentorship, and service contributions was an issue of caregiver inclusion (because caregivers' time constraints meant that time spent on such activities came out of their finite available time for publishing and grant writing)—but it was also an equity issue. As one articulated,

I am an underrepresented minority woman in a STEM field. That's not in any of those metrics. And the number of students that I talk to about those questions, about their imposter syndrome or whatever, none of that is taken into account. And so I think it goes way beyond caregiving. It's this whole bucket of things that I might be doing that shows up nowhere.

Caregivers particularly challenged what they viewed as a narrow focus on publications and research funding. They contended that tenure and promotion decisions could involve a more expansive, individually tailored assessment of a scholar's contributions that would include “various models of promotion or achieving success that are accounting for all of the diverse ways that we're able to engage in our professional lives.”

From an equity perspective, interviewees accorded special importance to the need to weight and reward mentorship activities.

I think much more mentorship, and mentorship not just people of color or marginalized groups mentoring people of color and marginalized groups, but people who are successful and have achieved a certain level of success reaching back and supporting those who are marginalized intentionally as the value system and agenda for the institution.

Put mentorship on the NIH [National Institutes of Health] biosketch. Because women do a ton of mentoring, and if it was required on the NIH biosketch, there might be a lot more sharing of mentorship responsibilities.

Caregivers further noted that quantity-based academic success standards placed those with caregiving responsibilities at an irremediable disadvantage. Such metrics, they suggested, often reflected more about the presence or absence of competing time demands and less about an individual's scientific or professional contributions or potential.

These metrics, extramural funding and publication quantity, not quality, are faulty ... the number of [expected] publications has increased over the last few years and it pushes bad science [and] makes caregivers look worse on applications. If they assessed through impact, someone who is a caregiver that is dedicated to high quality would be seen differently.

[Ideally], there wouldn't be as much sole emphasis on just productivity, productivity.... It's not always a measure of how creative you are, how intelligent

you are...a huge part of [productivity as traditionally assessed] is, do you have the time to dedicate.

Caregivers argued that concepts of academic productivity should be updated to reflect contemporary avenues for scholarly impact and to prioritize innovative, transformative contributions within and beyond the academic workplace.

Tenure guidelines across the country need to be updated to look at other areas apart from just traditional number of papers and the number of grants. The world is different today, and publishing a paper is not actually what causes the greatest impact or practice change... What was the uptake of that work apart from just traditional journal publications and grants? And I say that as a person [with], like, 225 journal publications. I've had \$90 million in grants. I've played that game. But the world is changing, and we have to recognize there are other ways to make impact.

My measure of success is transformation as a positive contribution to the department. So, meaning I've changed and improved something that already exists, versus just pumping out publications. I'm working on curriculum development; it's better because I was there. I'm working on different modes of teaching; the teaching is more well-received and more engaged than it was before. So in some way, measuring transformation or improvement or development versus just volume, I think could be helpful. The way I see my success is that I'm doing things to make not only the department better but to make the care that we provide our patient population better.

Interviewees also argued for measures to make part-time careers a viable option in academic STEM. Through concerted funder and university action, they argued, it should be possible to build alternate frameworks to appropriately assess the contributions of part-time scientists in grant review and tenure evaluation.

With the federal funding, it's sort of like an all-or-naught model. You're always either in or you're out, and there's no real good way that you can do things a little bit slower and still have responsibility.... For many grants, you have to be full-time faculty to even be able to apply. Why could I not be .8 faculty or .6 [full-time equivalent]? ... That model really needs to be addressed. You can't have full-throttle [requirements] and work-life balance or be inclusive ... those things are at odds with each other.

Finally, many respondents (including senior faculty) noted that early-career scholars were typically hit harder by conflicting career-caregiving demands but also typically had fewer financial resources that could be used to alleviate those demands. For this reason, some felt that forms of caregiver support that came with negative financial implications—for example, giving a person an additional year before the tenure review—were counterproductive to caregivers' efforts to leverage their own compensation to relieve conflicting time demands (e.g., through paid eldercare, childcare, or housing located closer to the university). One senior interviewee proposed a reverse pay scale that would allocate the highest compensation to early-career

scholars, with compensation declining over the course of the academic career with the expected decline in caregiving demands.

Care-Centered Academic Workplace Norms

Many interviewees spoke to the need for radical change in the culture of academic STEM workplaces in the United States, rejecting what they saw as the primacy of competition and individualism over care and collaboration. Caregivers of color and those from immigrant backgrounds made a compelling case that academic STEM workplaces would do well to adapt their cultures to incorporate some of the assets reflected in nondominant cultures, particularly around valuing care and collaboration.

Some noted that recognizing and rewarding teamwork and collaboration—rather than focusing so heavily on first author (or senior author) and principal investigator status—could open up opportunities for caregivers. Recognizing all contributors to a collaborative effort would not only allow caregivers with limited time to make modest contributions in more arenas, but might also make leadership roles more tenable (by promoting more active engagement from recognized and motivated collaborators). A more team-based approach, interviewees argued, would also more effectively tap the strengths of caregivers of color whose collaborative problem-solving skills were already well honed.

When you become a caregiver, you acquire so many skills that are very helpful in teamwork. So, I think if academia starts valuing more than achievement, how good you are as a collaborator, I think a lot of caregivers coming from...a minority background will be very successful because by definition...it's not by definition, by history, I mean the people who come from minority backgrounds, they have to struggle. So, there is a lot of valuable skills in that journey that can be very helpful in teamwork.

Interviewees advocated incorporating “the values of caregiving” into the broader culture of STEM workplaces. Rather than making special accommodations for caregivers, some suggested universal changes that made academic STEM workplaces more consistent with a balanced life and substantial priorities outside of work.

We have a rule here that ... everything has to be done by 5:00 because day care pickup is 5:30. So, as a department, we don't do anything that starts after 4 o'clock. It's a very simple policy, but it's very impactful.

Universalizing a culture of work-life balance, they suggested, could place caregivers on more level footing with their peers (“nobody's not showing up, nobody's not doing their job”). But it also promoted work-life balance for everyone in the department. Many caregivers made the point that an academic STEM culture that valued caregiving would be healthier for non-caregivers as well.

If caregiving values were incorporated, I think standards would just be a little bit more realistic, and I think there would potentially be more room for people to be a little, a little more sane. just because there would be room for that, like, life balance. because, like I said, I don't think just because if your kids are older, or if you don't have kids, I don't think there's any harm in taking breaks. I don't think caregivers exclusively need that. I think *people* need that.

Interviewees suggested that valuing care and recognizing caregiving responsibilities was central to cultivating a more holistic, less mechanistic regard for oneself and others in the STEM workplace. As one interviewee who had supervisory responsibilities explained,

It's [about] preparing for contingencies ... having awareness that we're working with people, we're not working with machines, and that people have needs.

Some caregivers who had advanced into positions of academic seniority also noted that their own efforts at transforming academic "grind culture" in the spaces where they had influence had unanticipated positive effects on their mentees' and labs' scientific success.

I think that's difficult to measure, but [my] lab is seen as a very supportive place and a place where people [excel] scientifically and personally. I think a lot of this stems from the fact that I was the first person in the lab to have a child ... that really changed my view on motherhood and caregiving and their challenges and responsibilities, and I think that made me a much more nurturing and supportive mentor for all my trainees—not only the ones who are having children but for everyone. So in that sense, people in the lab are very happy. Happiness is very difficult to measure, but we are very successful at recruiting really good people, and the people who leave the lab do very well.

The kinds of changes that made academic STEM culture less hostile to caregiving, they suggested, made it more humane—and even, perhaps, more productive—for everyone.

Contributions of Caregiving

Though caregivers recounted the tremendous challenges of fulfilling their caregiving responsibilities in the context of their STEM studies and careers, they also emphasized the incomparable richness it gave their lives.

I mean, having children is the most joyous thing I've ever, ever known...there's no question about that. Putting all the ... logistical issues aside, I would not trade that for anything.

Even, or sometimes especially, those who had experienced serious loss and sacrifice in managing career-caregiving conflict conveyed with equal intensity the deep joy and importance of caring for loved ones. "Seeing someone through the best and the worst" was a central source of meaning, purpose, and positive self-regard for caregivers.

It's not a resentment thing. I just very much like to take care of my family. I always do take care of them ... culturally, I think it's just expected [and] I never resented it.... It comes from a place of love for me, and a place of family, and a place of duty.

STEM scholars chose to offer needed care to their loved ones even when it was physically, emotionally, and mentally difficult and even when doing so meant risking a career that also meant a great deal to them: it was “brutally hard, but a really good thing.” As a scholar who had raised three young children while caring intensively for both of her parents in her home during their final years recounted,

I have this incredible image that I will never lose and never forget ... my 3-year old was helping my 90-year-old dad button his cardigan because he couldn't do it. His fingers were so arthritic.... It was the most extraordinary thing. And without giving ourselves the ability to take care of our loved ones, you're not going to have those moments. I'll never wipe that image from my mind of a 3-year-old helping a 90-year-old. That was really special.

For many, experiences of caregiving represented not only their “biggest joy” but also an unrelinquishable part of their humanity.

CONCLUSIONS

This study explored efforts to manage caregiving and a STEM career among a sample comprised largely of scholars of color, those from immigrant families, and those who were the first in their families to graduate from college.

Across career stages, participants' experiences with confronting career-caregiving conflict were shaped by a complex set of individual, interpersonal, institutional, and structural influences. At the micro-level, these included household structure, the nature of a scholar's caregiving and professional roles, and the presence or absence of supportive personal and professional connections. At the meso-level, workplace caregiving and collegiality norms, leaders' and supervisors' knowledge of institutional supports and willingness to offer them, and the presence of supportive figures in the workplace were all important influences. At the macro-level, caregivers' experiences were heavily shaped by their cultural assets and values; dominant-culture norms around gender, family, and care; and structural advantages and disadvantages that shaped caregiving-related interpersonal negotiations and assessments in the workplace as well as the private and institutional resources that caregivers could (or could not) draw on to weather times of intense career-caregiving conflict.

The study's key limitations are based in its small, qualitative nature. Due to the use of a non-probability-based sample, interview findings cannot be formally generalized to a broader population. The reliance on semistructured interviewing allowed respondents to share

experiences in their own words and to prioritize in their remarks what was most salient for them but did not entail obtaining systematic responses from all participants. As such, some aspects of every caregiver's experiences likely went undiscussed. Finally, although the purposeful sampling strategy succeeded in engaging a sample that was highly diverse with regard to racial and ethnic background, immigration status, family history of higher education, LGBTQ+ identity, disability status, career stage, and the nature and form of caregiving responsibilities, the smaller sample (N=40) meant that all potential combinations or intersections of these important life experiences could not be represented in the sample.

Caregivers' suggestions for improving support for those navigating career-caregiving conflict in academic STEM centered on supports that alleviated the scarcities of time and money that many caregivers faced. But they also shared visions of revising the standards and structures of promotion and grantmaking that shape pathways for STEM contribution and advancement and remaking STEM workplace norms to center an ethic of care and collaborative achievement.

Ultimately, the caregiving experiences and perspectives of historically underrepresented STEM scholars rendered through this work point to a pressing need to reimagine academic STEM in ways that will support healthier, more holistic, and more equitable visions of academic success and productivity.

REFERENCE

Sofaer, S. 1999. Qualitative methods: What are they and why use them? *Health Services Research* 34(5 Pt 2):1101.

APPENDIXES

A Web-Based Screening Form

B Semi-Structured Interview Guide

C Qualitative Codebook

APPENDIX A
WEB-BASED SCREENING FORM

1. Were you studying or working in the sciences, engineering, or medicine at a U.S. university at the time of the early COVID-19 pandemic (in 2020)?

- A. Yes
- B. No

If 1=no: This particular study is focused on understanding the experiences of individuals studying and working in science, engineering, or medicine at American higher education institutions in the context of the COVID-19 pandemic. We do not have any additional questions for you, but we truly appreciate your time.

[end screening]

2. Have you had regular, unpaid caregiving responsibilities for any of the following people during or since the early COVID-19 pandemic? By “regular,” we mean recurrent activities averaging >12 hours per week (for a single individual or across multiple individuals). Please mark all that apply.

- A young child, under the age of 5
- A school-age minor child, age 5–18
- An adult child, age 19+, with disabilities or physical or behavioral health needs
- A partner or spouse with disabilities or physical or behavioral health needs
- None
- An elder family member, such as a parent or grandparent
- A member of your extended family (e.g., a cousin or the child of a sibling)
- A chosen family member, friend, or anyone else outside of your immediate family

If 2=none: This study is focused on individuals who have had regular unpaid caregiving responsibilities. We do not have any additional questions for you, but we truly appreciate your time.

[end screening]

3. What kinds of responsibilities have you had for a person other than yourself during or after the early COVID-19 pandemic? Please mark all that apply.

- Supporting someone’s physical subsistence, such as dressing, bathing, toileting, feeding
- Supporting someone with daily living in nonphysical ways (such as living with a cognitive impairment, developmental disability, or autism)
- Supporting someone’s participation in online school or other remote learning
- Coordinating medical or behavioral health care for someone
- Managing someone’s day-to-day schedule
- Accompanying and/or transporting someone to regular appointments

- Managing someone's involvement with the immigration or criminal legal systems
 - Managing someone's finances
 - Other regular, unpaid caregiving responsibilities
4. Have you made any major changes in your educational or professional life because of your caregiving responsibilities? Please mark all that apply.
- A. Dropped out of school or out of the paid workforce entirely
 - B. Left an academic STEMM field in which you were trained (or had begun training)
 - C. Reduced your work hours or switched to part-time academic status within your field
 - D. Opted for more flexible work commitments within your field
 - E. Made other major educational or professional changes based on caregiving responsibilities
 - F. No major changes/not applicable
5. What is your highest earned degree? (If currently enrolled in a degree program, mark the previous highest degree received.)
- A. Master's degree
 - B. Doctorate
 - C. M.D.
 - D. J.D.
 - E. Other (please specify)
6. How many years has it been since you attained that degree?
- [number field that allows value from 0 to 65]
7. In what discipline do you primarily work? Please select the general category under which your work fits best.
- A. Astronomy
 - B. Atmospheric sciences
 - C. Biology
 - D. Biochemistry
 - E. Bioinformatics
 - F. Biomechanics
 - G. Chemistry
 - H. Computer science
 - I. Engineering
 - J. Geographic information systems
 - K. Information technology
 - L. Mathematics
 - M. Medicine: Specify field _____

- N. Nanotechnology
- O. Operations research
- P. Optics
- Q. Physics
- R. Robotics
- S. Statistics or computational science
- T. Other science, engineering, or medical discipline: Specify [field that allows up to 100 characters]

8. Are you still studying or working in academic STEM?

- A. Yes
- B. No

9. [if 8 = Yes] What is your rank within your school of primary appointment or affiliation?

- A. Graduate student
- B. Postdoctoral fellow or postdoctoral associate
- C. Lecturer (non-tenure track)
- D. Senior lecturer (non-tenure track)
- E. Temporary non-tenure track (including adjunct, visiting lecturer, and visiting professor)
- F. Assistant professor (tenure track)
- G. Associate professor (tenure track)
- H. Professor (tenure track)
- I. Academic leadership position (e.g., chair, dean)
- J. Other: Specify [field that allows up to 100 characters]

10. Are you the first person in your family to graduate from a 4-year college?

- A. Yes
- B. No

11. Do you identify as Hispanic or Latino?

- A. Yes
- B. No

12. What is your racial identity? Please select all that apply.

- A. American Indian or Alaska Native
- B. Asian
- C. Black or African American
- D. Native Hawaiian or Other Pacific Islander
- E. White

13. Do you have any of the following experiences with immigration?
- A. First-generation immigrant (you were born outside the United States)
 - B. Second-generation immigrant (your parents were born outside the United States)
 - C. Neither
14. Who lives in your household? Please mark all that apply.
- A. Partner(s), co-parent(s), and/or spouse
 - B. One or more minor children (18 and under)
 - C. One or more adult children (over 18)
 - D. Elder family member(s), such as your parent or grandparent
 - E. Other chosen family member(s)
 - F. Other family member(s)
 - G. Other individual(s) you don't consider family
15. What is your current gender identity?
- A. Man
 - B. Woman
 - C. Nonbinary
16. Do you consider yourself transgender, gender fluid, or gender nonconforming?
- A. Yes
 - B. No
17. Which of the following best describes you?
- A. Heterosexual or straight
 - B. Gay or lesbian
 - C. Bisexual or pansexual
 - D. Queer
 - E. Questioning or unsure
 - F. Other: Specify [field that allows up to 100 characters]
18. Do you have a disability or any major physical, sensory, or cognitive difference (such as deafness or autism)?
- A. Yes
 - B. No
19. How may we contact you about participating in an interview? Please mark all that apply.

- A. By email: Specify [field that allows up to 100 characters]
- B. By cell phone: Specify [field that allows up to 100 characters]

20. What name would you like us to use in contacting you about your participation? Please feel free to use your first name, full name, a nickname, or an alias.

[field that allows up to 100 characters]

Thank you very much for your support of the National Academies' work and for taking the time to complete this screening form. A member of our team will contact you within approximately 1 month about your possible participation in an interview.

APPENDIX B SEMI-STRUCTURED INTERVIEW GUIDE

Introduction (5 min.)

Thank you so much for making the time to talk with me today. The interview will last about an hour. In terms of flow, I'll first ask you a bit about your professional life, your caregiving, and how you manage the demands of the two. Then, I'll ask you about all the things that have affected how you manage those demands, from the "big picture" level of laws and institutional policies down to your interpersonal relationships and individual experiences. You are free to stop answering questions at any time or skip any questions you do not wish to answer.

Do you have any questions before we begin?

Experiences of Managing Career and Caregiving (16 min.)

I understand you are a [fill rank from screening form] working in [fill discipline from screening form]. I also understand [briefly recap your sense of the respondent's major caregiving responsibilities from screening form, including what they are doing, for whom, and whether/how it was affected by the early COVID pandemic in 2020].

Thinking about your work life, how much control do you have over when, where, and how you do your work? Where are you most constrained? *Probe for agency regarding work schedule (e.g., flex time) and location (e.g., telecommuting options).*

And how much control do you have over your caregiving? Where are you most constrained? *Probe for low-agency caregiving (e.g., elder parent needs frequent toilet assistance) and high-agency caregiving (e.g., elder parent needs checkbook managed monthly).*

Could you tell me a bit about how you've fit your caregiving into your professional life, and vice versa? How have you made it all happen from day to day? *If respondent has multiple caregiving roles (e.g., for a young child and an elder parent), also probe briefly for complementarity or conflict across those roles.*

What about the times when you *haven't* been able to make it all happen? What were the costs or consequences?

Have you ever had to make a difficult decision because of conflicting work and caregiving responsibilities? What did that look like? *Probe for ways that professional pressures have shaped major personal/family/caregiving decisions AND ways that caregiving pressures have shaped major career/professional decisions.*

[Skip for students not yet in the workforce.] Looking back across your training and professional career so far, how has the experience of managing simultaneous work and caregiving differed for you at different stages in your career? *Probe as relevant for graduate and professional school admissions and achievement, post-training placements (e.g., postdoctoral fellowships, medical*

internship and residency), job placement and advancement, tenure, full professorship, and promotion to academic leadership (e.g., chair, dean).

Everyday Context for Managing Career and Caregiving (12 min.)

Next, I'd like to get a sense of the cultural and interpersonal contexts that shape your management of career and caregiving responsibilities.

What circumstances in your day-to-day personal life have most affected your ability to manage a career and caregiving simultaneously? *Probe for living arrangements, family structure, social support, personal values.*

How has culture shaped your experience of managing career and caregiving, if at all? *Probe as needed:*

- *How is caregiving viewed in your family? How has that shaped your own experience of managing career and caregiving?*
- *What messages have you received about caregiving in your community? How have those shaped your own experience?*
- *In what ways, if any, do those family or community cultural messages about caregiving differ from what you see in U.S. mainstream culture?*

Probe for ways that cultural assets and resources may shape how respondent has managed simultaneous professional and caregiving roles.

What circumstances in your day-to-day professional life have most affected your ability to manage career and caregiving? *Probe for aspects of job responsibilities, work environment, and workplace culture.*

Thinking about your professional colleagues, mentors, chairs, or administrators, *who* has most affected your ability to manage career and caregiving simultaneously? How? *Probe for formal and informal communications and interactions in the workplace and with professional network.*

To what extent do you feel a sense of belonging among your colleagues? *Probe for how belonging or lack of belonging is telegraphed in the workplace.* How has that shaped your experience of managing career and caregiving demands, if at all?

Institutional and Structural Context for Managing Career and Caregiving (12 min.)

Many academic institutions have policies and practices designed to support work-life management, for example, paid family leave and tenure clock adjustments.

Thinking about the main institutions and organizations you work within or are affiliated with, what policies have most affected your experience of balancing career and caregiving?

And to what extent have you been able to take advantage of policies and practices intended to support work-life management? *Probe for barriers to accessing these policies and practices, such as hesitancy to ask about taking advantage of them.*

In practice, how helpful have these supports been for you? *Probe for extent to which respondent has accessed and/or benefited from putatively supportive work-life policies.*

How have structural factors, like structural racism or other forms of systemic discrimination, shaped who takes advantage of these policies in your workplace? *Where relevant, probe for influence of any structural disadvantages the respondent has described in the interview (e.g., How, if at all, have those factors affected your ability to take advantage of work-life policies?).*

At the broadest level, what laws or public policies have most affected your ability to manage your career and your caregiving roles?

Thinking about managing work and caregiving across your career so far, what's the biggest help you could have been offered but weren't? *Probe for thoughts on changing or enhancing aspects of policy, culture, and structural advantage/disadvantage. Anything else?*

Reimagining Success and Productivity (5 min.)

I'd also like to get your thoughts on the ways that success and productivity are assessed.

In many STEMM fields, the traditional ideal of academic productivity emphasizes publishing at a certain pace and obtaining extramural funding at a certain level. How do you think this productivity ideal might look different if [scientists'/engineers'/medical professionals'] unpaid caregiving roles and contributions were fully taken into account?

The traditional view of success in academic STEMM often centers on obtaining and then advancing within a tenure-track position at an R1 institution. How do you think this model of success might look different if [scientists'/engineers'/medical professionals'] unpaid caregiving roles and contributions were fully taken into account?

What alternative academic standards and norms would make academic STEMM a more hospitable place for caregivers, particularly caregivers of color?

Satisfaction and Joy (7 min.)

Looking back at what you envisioned for work and caregiving when you first set out on this career path, how does that vision compare to where you are now? *Probe for achievement relative to own expectations.*

Broadly speaking, how has your caregiving affected your ability to fulfill your professional aspirations? *Probe for any ways/moments that caregiving presented insurmountable career challenges. Probe for any ways/moments that caregiving supported professional aspirations*

(e.g., broadened the respondent's professional capacities, professional insights, or sense of professional meaning/purpose).

What are your greatest sources of joy in your professional life? In your caregiving?

Conclusion (3 min.)

What final thoughts and recommendations do you have for the National Academies study committee as they consider policies and practices for supporting caregivers in the STEM professions?

Thank you so much for your time and insights.

APPENDIX C QUALITATIVE CODEBOOK

Purpose

Complement CWSEM’s (Committee on Women in Science, Engineering, and Medicine) broader evidence review by addressing critical gaps in evidence on challenges facing science, technology, engineering, mathematics, and medicine (STEMM) students and professionals with caregiving responsibilities and promising strategies for supporting them, with particular attention to the experiences of women of color and caregivers of intersecting marginalized identities.

Guiding Questions

1. How do macro-level factors (including community cultural wealth and structural disadvantage), meso-level factors (including everyday interactions within institutions and social support networks), and micro-level factors (including personal identities, priorities, and household composition) shape the ways that caregivers working and studying in academic STEM fields
 - a. engage in and make meaning of various forms of caregiving?
 - b. navigate work-life balance and access policies and procedures designed to support it?
2. What alternative structures, standards, norms, and supports might better promote work-life balance for caregivers in academic STEM, particularly caregivers of color?

Family Codes

Data from each respondent’s screening form will be used to apply the following “family” codes to each transcript. Recognizing the multitude of distinct life experiences that are of potential relevance and the thickly intersectional nature of those experiences, we will not attempt to separate transcripts according to these experiences for structured, comparative analysis (as in a traditional analytic bin approach). Instead, we will review family codes for each transcript prior to inductive analysis. Any evident patterns in experiences relevant to the research questions by family code that emerge inductively in our transcript-by-transcript review will be documented as part of the theming process.

To offer context for the qualitative analysis, we will also generate simple, descriptive statistics (including frequencies and cross tabs) for the study sample by family code.

Domain	Family Codes
Nature of caregiving role(s) (all that apply)	Caring for a young child, under the age of 5
	Caring for a school-age minor child, age 5–18
	Caring for an adult child with disabilities or other health needs
	Caring for a partner or spouse with disabilities or other health needs
	Caring for an elder family member, such as a parent or grandparent

	Caring for a member of extended family
	Caring for a chosen family member, friend, or anyone else
Forms of caregiving (all that apply)	Supporting physical subsistence, such as dressing, bathing, toileting, feeding
	Supporting daily living in nonphysical ways (such as living with a cognitive impairment, developmental disability, or autism)
	Supporting participation in online school or other remote learning
	Coordinating medical or behavioral health care
	Managing day-to-day schedule
	Accompanying and/or transporting to regular appointments
	Managing involvement w/legal system (immigration, JJ, CLS)
	Managing finances
	Other regular, unpaid caregiving responsibilities
	Career changes made to manage caregiving (all that apply or none)
Left an academic STEM field	
Reduced work hours or switched to part-time status within field	
Opted for more flexible work commitments within your field	
Made other major educational or professional changes	
No major changes/not applicable	
Career path	Academic position
	Position outside of academia
Career stage or academic “rank”	Student or trainee (graduate student, resident, postdoc, etc.)
	Junior tenure-track faculty (assistant professor)
	Midcareer tenure-track faculty (tenured associate professor)
	Senior faculty (tenured professor, dean, other leadership position)
	Non-tenure-track academic position (lecturer, senior lecturer, adjunct, temporary, research associate)
Gender context in field	Working in physics, computer science, astronomy and astrophysics, or civil, aerospace, electrical, or mechanical engineering
	Working in another field
Ethnic and racial identity (all that apply)	Hispanic/Latino
	American Indian or Alaska Native
	Asian
	Black or African American
	Native Hawaiian or Other Pacific Islander
	White
Other experiences of structural disadvantage (all that apply)	First-generation college graduate
	Immigrant
	Living with a disability
	LGBTQ+

Deductive Codes

Codes by Domain, Construct, and Research Question		
Domain	Code	RQ(s)

Influences	<ul style="list-style-type: none"> • Macro-level (e.g., community cultural wealth, structural disadvantage) • Meso-level (e.g., everyday interactions within institutions and social support networks) • Micro-level (e.g., personal identities, priorities, household composition) 	1
Work-life management	<ul style="list-style-type: none"> • Autonomy (or lack thereof) in caregiving • Autonomy (or lack thereof) in professional life • Career constraints associated with caregiving (e.g., impact on career options or ability to meet expectations of position) • Caregiving constraints associated with career (e.g., limitations on time with children or elders) • Personal consequences of managing joint responsibilities (e.g., stress) • Individual strategies for managing joint responsibilities • Career achievement relative to expectation 	1
Informal supports	<ul style="list-style-type: none"> • Supportive figures in personal life • Other supportive aspects of personal circumstances • Supportive figures in professional life • Other supportive aspects of professional circumstances (not covered elsewhere) 	1, 2
Access to work-life policies	<ul style="list-style-type: none"> • Helpful formal supports • Unhelpful formal supports • Formal supports not accessed • Reasons for using/not using formal supports • Impact of using/not using formal supports • Biggest help you could have been offered but were not 	1, 2
Reimagining productivity	<ul style="list-style-type: none"> • Research-related productivity ideals (e.g., funding) • Dissemination-related productivity ideals (e.g., presentations publications) • Alternative productivity ideals 	2
Reimagining success	<ul style="list-style-type: none"> • Academic prestige • Tenure process • Alternative markers of success 	2
Satisfaction and joy	<ul style="list-style-type: none"> • Ways that caregiving supported professional contributions • Greatest source(s) of joy in professional life • Greatest source(s) of joy in caregiving 	2
Modifier Codes		
Floating (any domain)	<ul style="list-style-type: none"> • Helped (facilitated, supported) • Hindered (constrained, was a barrier) 	Both
	<ul style="list-style-type: none"> • Lost (diminished, worsened) • Gained (enhanced, strengthened, improved) • Stayed the same (neutral, no effect) 	