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A Comprehensive Literature Review of Caregiving Challenges to STEMM Faculty and Institutional Approaches Supporting Caregivers

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INTRODUCTION

This review considers the obstacles to intersectional gender equality among science, technology, engineering, mathematics, and medicine (STEMM) faculty due to caregiving demands, focusing on childcare as well as addressing eldercare and other extended family care responsibilities. There is strong evidence that caregiving is both gendered and racialized in the United States, including among STEMM faculty. We take an intersectional perspective¹ in this paper and map out the structural, financial, and cultural limitations that caregivers face in the academy, including how these obstacles have been impacted by the COVID-19 pandemic. The paper considers existing policies that may help address these inequalities, as well as some unintended consequences of such policies that are aimed at addressing care.

This review focuses on *unpaid care*, providing care for children, the elderly, other household members, and for extended family members with care needs. It examines the impact of care responsibilities for those in the STEMM faculty workforce, defined as university and college faculty in the areas of science, technology, engineering, mathematics, and medicine, although the review also draws on research that has been conducted on university and college faculty more generally. When we refer to research findings for STEM, this means that the work focused on faculty in science, technology, engineering, and mathematics; when we refer to research findings for STEMM, the work includes medical faculty as well; we also reference medical faculty when studies were done focused only on medical school faculty. This analysis of the impact of care can help explain the underrepresentation of certain groups, such as women, from STEMM faculty careers.

Throughout the paper, when we refer to gender, we almost always refer to reported differences between two cisgender categories: men and women. While in the most recent studies, there has been increased attention to collecting data for nonbinary and transgender participants, this data often has not

¹ Intersectionality is a framework that recognizes the interconnected axes of marginalized identities that can compound experiences of inequality and discrimination, originally defined by Kimberlé Crenshaw (1989, 1991). We attend to caregiving by gender and race wherever possible throughout this review and also consider additional social identifiers, such as sexuality, social class, and career status when available in the studies we cite.

been analyzed due to small sample sizes [1, 2]. In addition, there is relatively little literature that explicitly analyzes queer faculty members' experiences with caregiving [3, 4]. Other recent research studies that center queer, nonbinary, and trans faculty simply do not address caregiving [5–13]. Thus, the report is limited in its analysis of sexuality and gender identity.

Although women make up half of the population, they are underrepresented among STEMM faculty, particularly at higher ranks and in more elite institutions [14–20]. As Nina Gray argues about STEM faculty:

Underrepresentation of women is particularly pronounced and pernicious in STEM fields. In academe, 28 percent of STEM professors and associate professors in the United States are women, despite women receiving 40 percent of STEM Ph.D.s for the past 10 to 15 years [21].

Similar patterns exist in medical school faculties, where women are consistently underrepresented, and especially so at the tenured ranks [22]. This finding is further exacerbated for women of color: one estimate notes that women of color compose 15 percent of the U.S. population, but only 6 percent of STEM faculty [23, 24], and these findings are similarly poor for medical school faculty [22].

STEMM women are more likely to be diverted to less well-paying tenure-track jobs at 2-year or 4-year colleges, or end up in part-time, temporary, or non-tenure-track positions than men [17, 18, 20, 22, 25–29]. Overall, STEMM women earn less than men, controlling for a variety of relevant factors, with these gaps consistent even in the most recent cohorts [20, 21, 27, 30, 31]. Research also shows that even though STEM women's working hours in academia are similar to men's, they are less likely to be tenured and promoted and they are promoted more slowly than men, and these challenges are exacerbated for women of color [17, 20, 32]. Furthermore, a recent cross-national reconstruction of the publishing histories of STEM scientists from the 1950s through 2010 finds, counterintuitively, that the gender gap in journal publishing and citation rates has grown continuously in both domains over the same periods that women have entered these fields at unprecedented numbers [33]. Most of the effect is explained by

shorter overall careers among STEM women, due both to the leaky pipeline² at all stages and transitions from research into other types of higher education careers.

Research suggests that all of these inequalities reflect not only gender but also caregiving [17, 20, 29, 34, 35]. While research finds that STEM faculty members often have additional care responsibilities to parents and other family members, including coordinating their care needs [36, 37], parenthood looms particularly large. STEM women with young children are less likely to be employed, and less likely to be employed full time than men with the same characteristics [17, 27, 35]. In studies of academics broadly, women who have children soon after receiving Ph.D.'s are less likely to earn tenure than men who have children at the same time point [17]. Men who have children are *more* likely than childless men to be in tenure-track jobs, while women who have children, particularly young children, are less likely to be in tenure-track jobs than childless women [35] and all men generally [17, 18, 35]. Indeed, Perna [18] finds that parenthood is positively associated with tenure status for men, but not for women

The timing of fertility creates real challenges for many STEM faculty [17, 20, 35, 38–41]. Mary Ann Mason and colleagues note: “A female scientist with a child under six years old is 27 percent less likely to earn tenure compared to her male colleagues, whereas a childless woman is only 11 percent less likely to get tenure.” [17, pg. 57]. Associate women also move more slowly toward promotion, and earn substantially less than men [17, 32]. Even at the associate level, increased caregiving demands for children and other family members for women is associated with slower progression to full professor for women than men [20].

In this report, we begin by summarizing how caregiving responsibilities are gendered and racialized in the United States, and specifically among STEM faculty members. We show that both women and faculty of color are more likely to have caregiving responsibilities that conflict with work. In the next section, we more deeply analyze higher education as a racialized and gendered hierarchical organization, which assumes that “ideal workers” do not have caregiving responsibilities. We lay out how

² The “leaky pipeline” is a term originated to describe the loss of women at each stage of the STEM academic career trajectory, from schooling through academic careers [177].

both structural and financial limitations and cultural schema disadvantage caregivers, as well as the intersection of caregiving and the pandemic. Next, we lay out the primary policies and cultural strategies that have been adopted to address caregiving responsibilities, as well as some of the unanticipated outcomes to these efforts, including challenges in implementation of policies, difficulties with gender-neutral policies, financial limitations, and flexibility bias. We conclude with an overall summary of our key findings.

Gendered and Racialized Caregiving Responsibilities

Women in STEMM continue to be underrepresented in academia, in part due to gendered caregiving responsibilities. In 2022, approximately 56 percent of U.S. households included children of any age, and 40 percent included children under 18, while another 29 percent included adults over 65 [42]. These care responsibilities are similarly reflected in academia, though faculty men are more likely to be partnered and have children, given gendered time demands [17, 18, 20, 34, 39, 41, 43, 44].

Historically, caring in the United States has been understood as primarily the responsibility of the family, carried within the home, by women in the family or by other women, often women of color and immigrant women, who provided care through enslavement or were paid, often low wages, to provide care [45–49]. As such, taking an intersectional approach to understanding caregiving is important. During the 19th century upon the transition from an agrarian to an industrialized economy, care for children—particularly among the middle class—shifted dramatically from treating most children as economically useless small adults to innocent, priceless children, who required substantial care to develop their abilities to lead successful middle-class lives [45, 50]. This shift led to an intensification of mothering, particularly among white middle-class families, with mothers expected to devote substantial time and attention to caring for children’s growth [45, 51, 52]. The focus on mothering is further reflected in more recent cultural ideals regarding women’s “family devotion”—greater prioritization of care for family competing with “work devotion”—greater prioritization of work [53, 54].

Importantly these caring ideologies and relationships reflect hierarchies based on class, race, gender, and nationality [45, 47–49]. While some white middle- and upper-class mothers engaged in less paid work and focused on caring for children (as well as charitable work), this was less true for single mothers, working-class and poor mothers, and many Black, Indigenous, Latina, and Asian mothers, given differing ideologies of care by race, ethnicity, and class, and either need for or expectations for maternal employment, even among the middle class [51, 55]. Thus, middle-class racially diverse mothers may be employed, but engage in “extensive mothering,” delegating care for their children to others, while coordinating that care [56]. At the same time, both economic resources and racial preferences, including efforts to ensure children’s racial safety, may shape choices for care outside the family [57, 58]. Class and racially diverse women may also recognize their choices—whether to work outside the home, or focus on care within the home—as always “for the family,” rather than seeing “work devotion” at odds with “family devotion” [56, 59].

Family has also been defined differently for different groups. While white middle-class conceptions of family have focused on the nuclear unit, Indigenous, Black, Latine, and Asian people, as well as poor and working-class whites, also recognize a wider definition of family and kin [60–67]. Similarly, queer folx often define family more widely [68, 69]. This has wider implications, with substantial research showing greater caring responsibilities for parents, siblings, and family and friends of women, LGBTQ people, and people of color [61–67, 70–74]. By taking an intersectional perspective, it becomes clearer that care work is experienced differently for different groups. As Kossek et al. argue, “The social categories of intersectionality such as race, gender, and sexuality have meaning that is shaped by a particular historical and cultural context that imbues them (or not) with power and resources” [75, pg. 208].

In the United States, women spend more time on caregiving and face greater expectations for providing care. Nationally representative data from the American Time Use Survey consistently shows women’s deeper engagement than men’s in housework and childcare, although over time, men have increased their involvement in these activities [76–78]. Care responsibilities are not only for children.

Nationally representative data from the Health and Retirement Study shows that these gendered patterns continue as women age [79, 80]. Women are more likely to provide care for parents and for grandchildren than men [79], while daughters are more likely to provide care for elderly parents than sons, with sons providing even less care when they have sisters (and daughters providing more care when they have brothers) [80].

In addition, members of minoritized groups³ are more likely to be providing care for extended family such as siblings and parents, based on nationally representative data from the National Survey of Midlife Development in the United States [81]. One study, based on the National Study of Caregiving (linked with the National Health and Aging Trends Study), shows that white people spend fewer hours per month than Latine and African American people helping family members with care (including activities such as moving, bathing, eating, dressing, toileting, as well as shopping, household chores, paying bills, managing medical care) [82]. This study also finds that white and Latina women spend more time on care than white and Latino men, although African American men and women's hours are more similar [82]. African Americans are significantly more likely to be providing high-intensity care to family members than white people [82].

These caregiving burdens are also reflected in the experience of faculty. One survey study carried out at a research-intensive public institution in the Northeast, looks at the relationship between working hours and carework outside of the university for all faculty [34]. This research shows that faculty of color spend more time than white faculty on eldercare and long-term care, mirroring national data that shows an association between care and race [34]. Women spend substantially more time on housework and childcare, relative to men, controlling for other relevant factors, while both men and women are equally absorbed with eldercare and long-term care for family members [34]. Queer faculty may also be

³ We use *minoritized* to acknowledge that the term “minority status” is socially constructed, reflecting group disadvantage and systemic inequality relative to “majority status” groups, those who comprise historically privileged social identities [178].

differently involved in caregiving, given efforts to nonnormatively assign and share care, including considering a wider group as among those queer faculty care for [3, 4].

One nationally representative and longitudinal study following STEM professionals who did, and did not, have children during the study period, finds that new parents are less likely than childless professionals to remain working full-time in STEM after the birth or adoption of a new child, controlling for other relevant factors [83]. Nearly half of new mothers (43 percent) and one-quarter of new fathers (23 percent) leave full-time STEM employment 4–7 years after the birth of their child [83]. Some of these parents move to full-time jobs outside of STEM, with 38 percent of fathers and 71 percent of new mothers citing family-related reasons for changing jobs [83]. New mothers are also more likely to move into part-time jobs inside or outside of STEM or leave the workforce than new fathers [83].

In a national survey study of academic physicians who had won very competitive National Institutes of Health (NIH) K08 or K23 awards, among married participants with children, women spend dramatically more time on parenting and domestic tasks than men; this is also true when focused only on those households with two full-time working partners [43]. In addition, women are much more likely to stay home with children when they are ill or there are childcare disruptions [43]. This additional time spent on care work for women is also correlated with less time spent on research [43]. As Jolly et al. comment: “Indeed, research time may be the most flexible aspect of a medical academic career and therefore the one most amenable to compromise when competing demands exist. Alas, it is also the activity most critical to academic success” [43, pg. 8].

One study of faculty at a large research-intensive midwestern university considers how professional life interferences due to caregiving for children impact pre- and post-tenure faculty members’ career satisfaction and retention [44]. Professional life interference is captured through measures such as travel curtailed, inability to work weekends and nights, loss of opportunities, and unexpected time away from work. Both pre- and post-tenure women are more likely to experience professional life interference due to caregiving for children than pre- and post-tenure men [44]. Further pre-tenure women experiencing professional life interference are more likely to consider leaving their job

and feel lower career satisfaction than pre-tenure men experiencing these interferences [44]. The researchers further find that whether pre-tenure faculty report equally sharing parenting responsibilities with their partner or having primary responsibility, women nevertheless report the same level of professional life interference [44].

One large-scale longitudinal interview study of women faculty members with children at a wide range of academic institutions provides more detail about how balancing work and family operate for early-career (first wave) and mid-career (second wave, approximately one decade later) faculty [84]. Mothers note the unforgiving nature of the tenure clock, as well as the additional work they had to do to consider their own biological clocks in relation to their careers [84]. In the second wave of interviews, mothers explain that parenthood, in some cases, hampers career mobility. Women in STEM fields in the study tend to emphasize their isolation, as well as the additional mentoring and service they need to do, given fewer women in their fields [84]. Yet, STEM mothers, relative to other mothers, were more likely to work collaboratively, particularly in lab-based fields, which helped them maintain productivity even during periods of intense caregiving. The study also identifies that many women make choices about which institutional type to work in—or when to leave jobs—based on perceptions about how possible it is to balance work and family [84].

Parenthood is not the only caregiving challenge faced by STEMM faculty. In one study of medical school faculty at 14 different universities nationwide, approximately one-fifth provide ongoing care to a family member, friend, or neighbor with a chronic illness or disability, with women and minoritized faculty more involved in this care than men and white faculty [37]. The researchers find that almost all caregivers report mental and emotional strain as a result of caregiving [37]. Another study, based on a survey of early-career medical faculty with substantial and competitive career development funding (such as NIH R01 or K awards), found that this highly productive group experienced a range of care needs [36]. More than half of all these early-career faculty had a child or adult in their household hospitalized in the previous year, or coordinated care for a child with a debilitating illness or eldercare, assisted living, or hospice care for someone inside or outside the home [36]. These faculty also note that

care responsibilities get in their way of conducting research, including the challenge of finding affordable childcare. As Hartmann et al. conclude: “Our survey results indicate that we should expect the majority of early career faculty researchers, both women and men, will experience substantial caregiving challenges and stressful life events in any given year. These are not rare occurrences” [36, pg. 1710].

Research further finds that work-family conflict impacts not only STEM faculty but also graduate students and postdocs, showing that many highly educated STEM professionals—both men and women—choose to leave STEM due to these anticipated conflicts. Based on a random sample of 3,455 graduate students, postdoctoral fellows, and tenure-track/tenured faculty members in the top 20 Ph.D. programs in astronomy, physics, and biology, one study found that a quarter of women and men graduate students are considering a career outside of science [38, 85]. These men and women in STEM are also more likely to be in a commuting relationship, or live apart from partners, due to the challenges of finding jobs in the same area, a problem particularly critical for women, who are more likely to have a partner or spouse in STEM [38]. In the study, about a quarter of graduate men and women; about a third of postdoc men, postdoc women, and faculty men; and almost a half of faculty women report challenges with work-family conflict [85]. Across all three groups, women are more likely than men to say that they have or will have fewer children than they would like [38, 85]. Two-thirds of men who took part in follow-up interviews with a stratified random sample of survey recipients from this larger study note that they have to modify their work schedules in order to balance work and family, suggesting that care demands impact men as well as women [38, 86]. Damaske et al. analyze interviews with 74 men, finding that approximately one-third see themselves as “egalitarian dual earners,” actively engaged in housework and care [87].

In a survey study of STEM men and women faculty at research intensive universities, both men and women report the mutual interference of work on family life and family life on work, though women were more likely to experience these challenges than men [88]. In a study carried out with five STEM women at a large public research university, the researcher found that all of the women interviewed had to develop alternate timelines for promotion due to the impact of caregiving—for family members and students, colleagues, and the institution (through service)—on their research agendas [89].

A study, carried out primarily with STEMM postdocs and faculty at a large, research-intensive midwestern university finds that postdocs and faculty who perceive institutional support for their family responsibilities report higher levels of workplace belonging and job satisfaction [90]. The researchers further find that the lower perceived institutional support had a stronger negative impact on belonging and job satisfaction for women postdocs in STEMM fields than for men postdocs in STEMM fields, though this field-specific effect was not found for faculty [90]. Another study, carried out with STEM faculty at a midsize midwestern university, finds that while gender is associated with work-life conflict, once “psychological safety,” an index that measures collegial support, safety with risk taking, and opportunities to address challenges, is included in the model, gender no longer predicts conflict and an interaction between gender and psychological safety is also insignificant [91]. This suggests that while women are somewhat less likely to feel psychologically safe, both men and women experience greater work-life conflict in departments that are less supportive [91].

These findings suggest that institutions can be structured in ways that are either more or less supportive of caregiving. These structures also matter to whether faculty feel a sense of inclusion and belonging. The next section of the review considers how universities are racialized and gendered organizations, identifying how this organization leads to structural and financial limitations, and cultural challenges, to caregiving STEMM faculty.

Racialized and Gendered Hierarchical Organizations

The organization of academia is both racialized and gendered within a hierarchy of career statuses. By this, we mean that work is organized in ways that make assumptions about who is carrying out the work, and how their lives are organized in ways that reflect gender and race, as well as one’s hierarchical status in the university. Despite their progressive reputation, universities are highly conservative institutions with respect to their differentiation by rank and career status, which correlates strongly with gender and race. The highest representation of women and people from minoritized groups

in the university are in student and staff roles, positions with least power in terms of decision-making, autonomy, and/or salary.

The faculty role is also traditionally hierarchical, with disproportionate numbers of non-tenure-track and assistant professor positions held by women. In 2020 for all postsecondary faculty, faculty of color compose 23 percent of instructors, lecturers, and other faculty; 30 percent of assistant professors; 26 percent of associate professors; and 21 percent of full professors [92]. For the same group, women composed 52 percent of instructors, lecturers, and other faculty; 53 percent of assistant professors; 47 percent of associate professors; and 35 percent of full professors. Importantly, women of color compose 13 percent of all instructors, lecturer and other faculty; 14 percent of assistant professors; 12 percent of associate professors; and 7 percent of full professors, indicating the particular disadvantaged position of women of color at the highest ranks [92]. Non-tenure-track faculty roles in the university are much lower paid and they lack many benefits; both assistant professor and non-tenure-track faculty lack job security, and often have fewer voting rights and other benefits. Within tenure-track positions, the proportion of white men increases at each higher, more powerful rank, with the highest number populating full professor ranks and leadership positions throughout the highest levels of the university administration. Indeed, white men made up 50 percent of all full professors in 2020 [92].

Within this power structure, those most likely to be engaged in care work are women and minoritized faculty. The university workplace was originally set up for an “ideal worker” who had no caregiving responsibilities, imagined as a white, heterosexual, upper-class man [15, 23, 93–97], and given the fact that those who continue to hold the most influential positions in the university are white men, the ideal worker remains the default. As Gatta and Roos argue, the assumption is that faculty have a “full-time wife at home fulfilling the roles of childcare worker, eldercare provider, maid, launderer, and chef, among other duties” [95, pg. 124]. The organization of STEM has not dramatically changed, even as the composition of the faculty, particularly at the lower ranks, has changed, and more and more STEM faculty—of all genders—engage in care as well as work [85, 96]. In addition, increasingly faculty are

more diverse by gender, sexuality, and race; are more likely to be partnered with other employed people; and are responsible for more caregiving.

As Kossek et al. argue, intersectionality means that even if institutions put in place some caregiving supports, some groups may not be able to access these supports, with these effects particularly salient for those from more disadvantaged groups [75]. For example, if parental leave is unpaid, single parents may be less able to access leave. Similarly, if parental leave is aimed at caring for newly born babies, faculty who provide foster care or adopt older children may not benefit from the leaves. If faculty who foster or adopt older children are more likely to be class and racially diverse, such systems reinforce existing inequalities. Hierarchical structures may also mean that paid parental leave is aimed at tenure-track faculty, so that faculty in non-tenure-track positions cannot benefit. A lack of paid care leaves for extended family members may also be more likely to impact faculty of color, who provide more care for extended family members. Queer faculty may find it more difficult to access care leaves for their chosen family. These identities intersect in ways that might mean that certain faculty are much less likely to use and benefit from institutional support for caregiving than others, and the experience even of those who do access the supports may differ by their identities [75, pg. 232].

As noted by Winslow and Davis, the neat, linear, and hierarchical organization of academic careers—graduate school, postdoc, assistant professor, tenure, associate professor, promotion, full professor—does not recognize how care responsibilities may impede progress [20]. Indeed, the time-delineated tenure clock often hits academics precisely at the life stage when they would ideally have children [14, 17, 20, 41]. Faculty may have somewhat more autonomy than workers in some other sectors, yet this does not necessarily translate into control over their work-time, given the intensity of work demands [39]. As narrow and rigid timelines disadvantage faculty with caregiving responsibilities, women faculty, faculty of color, and queer faculty are particularly less likely to attain tenure and promotion if they are responsible for substantial care. In addition, in earlier generations, most faculty members experienced a distinct separation between time at home and time at work. While STEM faculty needed to spend substantial time in their labs, when at home they were less engaged in paid work.

In recent generations, technology has made those boundaries extremely porous, with many academics working not only in the office for set hours, but from home and in in-between zones on their mobile devices, available to colleagues, collaborators, and students at nearly all times.

Structural Limitations and Financial Costs

Work-time expectations in STEMM faculty careers are intense. The organization of academia reflects a “greedy institution,” which expects STEMM faculty to spend substantial and intensive hours working [16, 23, 34, 38, 83, 84, 96, 98]. The “ideal worker norm,” as described by Kachchaf and colleagues, “includes commitment to the job through long hours, unbroken career trajectories, and constant availability and visibility,” which assumes that the faculty member has no care responsibilities, and indeed, is cared for by other members of their household [23, pg. 176]. This can be exacerbated for faculty whose intersectional identities are particularly disadvantaged [75]. In an interview study of women of color in STEM, one woman notes that her department chair questioned her work ethic and effort, and as a result she kept detailed logs of her time in the office to defend herself against his accusations [23].

These careers also assume not only full-time employment at every stage but extremely long hours; relatively few institutions provide opportunities for faculty to move to part-time employment when engaged in substantial caregiving. Researchers note that many STEM faculty are expected to work “60–80 hours per week, without time constraints or boundaries” [86, pg. 9]. Indeed, studies show all faculty work substantial hours, considerably longer than other professional occupations, and across an array of institutional types [34, 38–41], though hours are particularly long at research-intensive universities [40]. These pressures can be exacerbated for women of color [23]. Long working hours have a particularly strong impact on faculty members who are partnered with other full-time workers—more than half of all academic men, and nearly all academic women [38–40, 43, 44, 84].

The “tenure clock” directly conflicts with the prime transition to parenthood time for most faculty members who want to have children, an effect exacerbated in STEMM fields that emphasize postdoctoral

training before entering faculty positions [14, 23, 41]. Drawing on data from the National Study of Postsecondary Faculty, which includes both STEM and non-STEM faculty, Jacobs and Winslow show the more hours faculty members work, the less satisfied they are with their job [40]. Another study, using the National Study of Postsecondary Faculty but focused on those in STEM fields, finds that women spend more work-time on undergraduate education than men, though this effect dissipates in departments that have a “critical mass” (15 percent) of women [94]. Generally, women in fields with more women are more likely to allocate their time in ways that match men’s and are more satisfied with their jobs as a result [94].

Research also considers how faculty parents spend time on work. Men and women with children, as well as married men and women, work slightly shorter hours than childless men and women and unmarried men and women [40, 54, 85]. In one survey study at a research-intensive public institution in the Northeast, researchers found that women with children under 12 spend *less time* on research, though they continue to spend similar amounts of time on teaching, mentoring, and service work; there is no such effect for men with children under 12 [34]. Although fathers also cut back on work-time, they are more likely than mothers to protect their research time [34]. Thus, both mothers and fathers face time pressures due to care responsibilities, but they have differential effects on women’s and men’s distribution of work-time.

Most universities provide relatively little support for caregiving of children, elders, or other family members. Although the U.S. Family and Medical Leave Act (FMLA; P.L. 103-3) allows faculty 12 weeks of unpaid leave, the financial costs to faculty are high, especially given the high costs of medical care in the United States, which are seldom entirely covered by insurance. Faculty may also be providing for extended family members who need support due to health care or other issues [16, 23]. Certain intersectional groups, such as single mothers, or younger, less-well-earning faculty, may be less likely to be able to afford unpaid leave [75]. Few institutions provide subsidized childcare for children below school-age or subsidized private schooling on-campus. Lack of childcare or childcare availability has dramatic effects on choices of STEM women [38]. Many conferences further do not provide

childcare, and faculty must either skip conferences, make very short conference visits, rely on family members to care for children during conferences, or pay for childcare themselves, costs of which can be prohibitive [99, 100].

While academia has more flexibility than some other occupations, there are few supports that enable faculty to enact that flexibility on campus. In addition to the lack of available and accessible childcare facilities on university campuses, overall child-friendly infrastructure is lacking. While research on mothers generally shows that lactation supports at work mean that mothers are able to breastfeed for longer [101], in most higher education settings, lactation rooms and bathrooms with diaper-changing equipment largely do not exist [102], and some colleges and universities explicitly prohibit faculty and staff from bringing their children to work [103].

Relatively few institutions provide support for caregivers of family members with serious health issues or elders. While caregiving in these situations tends to be relatively short and very intense, compared with childcare needs that may be easier to predict, few institutions recognize such caregiving needs. For example, few institutions allow for paid leaves, modified duties, or allow faculty to shift to part-time status when managing health care or eldercare responsibilities. While corporations have increasingly invested in more flexible working strategies, as well as “on-site child care and home catering, post office, dry cleaning, pharmacy, and exercise facilities,” changes have been slower in the academy [14, pg. 2]. Some institutions provide support for finding caregivers or care facilities, though the costs for paid caregiving may be prohibitive for many faculty members. Generally, outside of parental leave, there is little support for faculty caregivers.

Grant funding and deadlines can also be challenging for faculty with caregiving responsibilities. Early-career grants, for example, often need to count faculty as “early career” longer if they hope to target faculty who have caregiving responsibilities. Grant panels may review faculty credentials in ways that regard gaps due to caregiving responsibilities as a negative factor in STEMM funding opportunities [97]. Similarly, faculty colleagues may evaluate faculty with caregiving responsibilities more harshly.

At the same time, there are a range of gendered opportunity costs to caregivers. As research by Wolfinger and colleagues show in a nationally representative study of Ph.D.'s, while married or single men with children are much less likely than single childless men to end up in a non-tenure-track "adjunct" position, single childless women, married childless women, single mothers, and particularly married mothers are much more likely than men to end up in non-tenure-track positions [35]. As they argue:

For men, young children push them to obtain more lucrative and potentially secure employment, either via tenure-track positions or outside academia altogether. In contrast, young children lead female doctorate recipients to work in less demanding, more flexible, but lower-status adjunct professorships [35, pg. 1606].

Women with young children are not only less likely to be successful on the job market at attaining tenure-track jobs, and they are also more likely to leave academia. For example, women Ph.D.'s with young children are 4 times more likely than women without children to leave the labor market entirely [35].

While most universities invest substantially in faculty, they underinvest in providing programs or awards aimed at faculty who have dual-career issues or caregiving responsibilities. Thus, faculty partnered with other faculty members may find it more challenging to find jobs together and may need to commute or simply step out of STEM careers [38]. For example, in one study, a dean resigned after her institution, which did not hire her highly esteemed husband, refused to allow her to telework 2 days a week to make her commuter relationship less challenging [98]. Women are much more likely than men to be partnered with someone working full time.

Cultural Challenges

In addition to the ways that universities are structured, there are also important cultural barriers for caregivers. The ideal worker norm assumes a set of productivity standards, which reinforces the need to work round the clock with little recognition of caregiving needs (or physical limitations of the faculty

members themselves). There are also perceptions of caregivers—particularly women—as less committed to work that create poisonous cultures and make it more challenging for mothers, for example, to attain tenure and promotion. One study that includes faculty at a wide range of different institutional types finds substantial evidence for faculty—particularly women—engaging in bias-avoidance behaviors, such as not taking leaves, or tenure clock stoppages, missing important events, and not having as many children as they would like [104]. This effect is somewhat mitigated by supervisors’ support of work-family needs [104].

In one study of STEM and non-STEM faculty at a research intensive university, Kmec finds that STEM mothers are more likely to say that they have to work “very hard” on the job, reporting significantly higher levels of work intensity than STEM fathers as well as non-STEM mothers report, controlling for a variety of relevant factors [105]. Kmec interprets this as mothers in STEM, who are countering a wide set of stereotypes that suggest women and mothers are incongruous in STEM fields, have to work harder in order to avoid perceptions that they do not belong in their jobs [105].

Researchers also consider how cognitive framing may affect burnout. For example, those who adopt a “work devotion” schema where they buy into the provision of “undivided devotion” to their work interrupt problems such as “overload,” feeling exhausted and overloaded [53]. Blair-Loy and Cech suggest that workers who buy into a work-devotion schema embody

a cognitive acceptance of the legitimacy or intractability of work demands, a moral and emotional identification with one’s employer or profession, inspiration and transcendence of personal limitations from the projects and relationships that work provides [53, pg. 9].

Yet this schema collides with a “family devotion” schema, which suggests that women are primarily devoted to caring for children, who are seen as in need of support and care. Examining a sample of Californian STEM workers connected to a nonprofit, they find that STEM professionals with a high work-devotion schema are less likely to feel “overload” except when they have young children. For those

with young children, the work-devotion schema does not erase the sense of overload that these workers feel, perhaps because the two schemas collide.

In a survey study of STEM faculty at nine research universities, researchers find more subtle clues about culture as well [88]. For example, women are less likely than men to talk about research with colleagues frequently, feel a sense of inclusion in their home units, and also see their units as more stressful than their male colleagues. In another study, researchers surveyed more than 2,500 graduate students, postdocs, and junior and senior faculty members in physics and biology, including 150 follow-up interviews to better understand why there are more women in biology than physics [106]. These researchers find that, regardless of the gender composition of their discipline, respondents stress innate differences between men and women and personal choices to explain these differences, with relatively few (mostly women) pointing to, for example, discrimination [106]. This suggests that cultural models emphasizing “personal choice” and preferences remain powerful.

Binder et al. refer to a faculty member who, despite family leave policies at the institution, “told lab members that taking family leave demonstrated a lack of commitment to a professional career and that those who took leave would not get positive references” [107]. This faculty member was trained regarding both norms on the campus and family leave rights [107]. Yet the researchers note that most supervisors avoid addressing disrespectful behaviors hoping for spontaneous resolution, even though these challenges often escalate into larger conflicts [107]. Thus, conflict avoidance can reproduce negative cultural climates for caregivers.

Pandemic Impacts

Although caregivers in academia have always faced substantial challenges, the COVID-19 pandemic intensified these challenges, given that for most faculty parents, schooling and childcare were disrupted [108, 109]. Research showed that women, in particular, faced substantial work disruptions due to caregiving [108]. At the same time, faculty of color were more likely to experience intense caregiving for family members suffering from COVID-19, as well as loss. The pandemic also coincided with greater

public attention to anti-Asian hatred and violence, as well as anti-Black racial violence, including the killing of George Floyd and its impact on the racial justice movement [108, 109]. Fulweiler et al. argue against institutions adopting policies that are gender or race neutral, stating “the effects of the pandemic are not neutral across race and gender” [110, pg. 5].

Quite early in the pandemic, researchers identified that while everyone was impacted by the pandemic, certain groups were experiencing particular pressure. For example, one study of papers published in medical journals in 2019 and 2020, which compares authorship for papers about COVID-19 with papers in the same journal the previous year, shows a significant decrease in women’s engagement as first authors and last authors, as well as authorship more generally [111]. At the same time, certain fields, such as computational work, saw less disruption [108]. Early-career scholars were particularly likely to note that their career options were being negatively affected by the pandemic [108]. While funders were relatively flexible about allowing, for example, no-cost extensions, most researchers could not receive additional funds for staff and students who were unable to carry out research during the worst of the pandemic [108]. Many STEMM faculty also lost opportunities to network and engage in collaborative research [108].

One of the most critical challenges during the pandemic was the increasingly “boundaryless” nature of work [108]. While all faculty were impacted by a loss of boundaries between work and home, this challenge was particularly exacerbated for caregiving women [108]. While providing childcare and schooling for children was widely experienced, particularly by women since they remained primary caregivers in many households, eldercare and extended family care also affected faculty members [108]. These problems were further exacerbated for mothers of children with disabilities [112]. These challenges led to a variety of negative outcomes regarding increased workload, decreased efficiency, and personal well-being [108].

A fall 2020 survey of faculty at a large urban U.S. university system that includes 2- and 4-year institutions comprising 3,219 participants examined the effects of the pandemic [113]. It found clear gender differences, with women experiencing more challenges managing their time, balancing work and

household responsibilities, and managing childcare/homeschooling children. The effects were larger for women in science and social science fields [113]. These challenges were also exacerbated for caregivers, with women caregivers experiencing the greatest difficulties [113]. While all groups noted spending less time on research during fall 2020 than they expected, there were important gaps, with women regardless of caregiving status, caregivers regardless of gender, and women caregivers in particular spending less time on research than their colleagues. There were also large gaps in research products by gender and caregivers status [113].

Another study, focused on midwestern academic medical faculty at one institution finds that men were more than twice as likely as women to see their productivity increase during the pandemic [1]. At the same time, the amount of time devoted to childcare also reduced productivity [1]. One survey of 1,185 medical, graduate, and health professions schools at one university shows that women were more likely than men to consider going part-time or leaving employment during the pandemic, with the strongest effect among women with children [114]. Both men and women with children were also more likely to consider going part-time or leave employment, and working parents as well as women were more likely to turn down leadership opportunities [114]. As Matulevicius and colleagues note:

Faculty women with children were the group most likely to report work-life balance stress even before the pandemic, and the pandemic heightened this further. This association of both gender and parenting with increased perceived stress may disproportionately decrease the long-term retention and promotion of junior and midcareer women faculty [114, pg. 6].

Thus, the research found that women caregivers were most strongly impacted.

One national study of 763 STEM tenure-track women finds a variety of approaches to adapting to the loss of work-nonwork boundaries [115]. Women faculty members were conscious of their professional image management, with some actively working to conceal (using a virtual background) or

reveal (normalizing nonwork interruptions) their personal lives [115]. They also engaged in role sacrifice, disengaging from work or nonwork demands, including trading off (prioritizing some tasks, postponing others), role withdrawal (abandoning career goals), or behavioral role exit (saying no to work or family demands). These strategies intersect with settings that varied in which structural supports (reduced demands, access to resources) or social support (leader or collegial recognition of personal demands) [115]. Where women received more structural and social support, they were more likely to reveal their personal lives, and less likely to engage in role sacrifice.

Another study of pre-tenure college and university faculty across the United States found that more than half of all faculty reported that faculty at their institution could request a tenure clock extension as a result of the pandemic, and another 41 percent were automatically granted tenure clock extensions [116]. Approximately 60 percent of faculty had taken pandemic-related tenure clock extensions, primarily due to reduced ability to conduct research in the pandemic, inability to collect pilot data for grant proposals, and decreased ability to write/submit manuscripts [116]. While the effect of having children in the home was marginal, members of minoritized groups, and surprisingly men, were more likely to take the tenure clock extension [116]. Those with caregiving responsibilities outside of their own children were also more likely to take tenure delays [116].

Yet institutional support has been fairly varied and inconsistent. Early in the pandemic, researchers considered the gendered and racialized impact of the pandemic on faculty lives, given caregiving needs, and called for institutions to reform their policies to better support caregivers [117, 118]. While noting that, for example, certain policies such as tenure clock extensions can exacerbate gender differences, these works have emphasized the importance of identifying strategies to avoid even wider gender gaps in STEMM as a result of the pandemic [108–110, 112, 113, 117–119]. For example, pandemic statements have played an important role in contextualizing for internal and external reviewers the work conditions for faculty during the pandemic, including their caregiving roles [109, 110, 118]. One case study, based at a research university in the Northeast, notes the importance of reworking evaluation

in order to recognize faculty work holistically, recenter diverse knowledge, rework timelines, recontextualize faculty work, and retrain evaluators to, for example, avoid caregiver biases [109].

Existing Policy Strategies

As already noted, some institutions have put policies in place meant to address the limitations and barriers STEM faculty caregivers face. While a companion paper further develops the policy context, we briefly discuss some of the most central policies being used by colleges and universities. One major challenge in this literature is that universities do not necessarily carry out rigorous studies of the effectiveness of their policies, often relying on anecdotal evidence about whether to maintain the policy, and not making their data or analyses publicly available. Thus, the effectiveness of these policies is not entirely clear, though we later discuss the unanticipated consequences and barriers to these policies.

One of the most consistent policies colleges and universities use are stop-the-clock policies, which may be provided for faculty parents who give birth, new faculty parents more generally, or faculty members providing care for sick or elderly relatives [2, 14, 44, 84, 120–123]. These policies have also been used to respond to the disruptions created by the pandemic [109, 118]. Faculty who have multiple children or caregiving episodes may be eligible to take multiple paid leaves, though some institutions limit the number of paid leaves [84]. These policies are often written to note that faculty should not be evaluated as if they had an additional year (or semester, etc.) before tenure, but should be evaluated as if they had the same probationary period as others [14, 38, 120].

Such policies should be made automatic to reduce flexibility bias, but also allow faculty to petition to go up for tenure at the original time, what is often referred to as “opt-out” [38, 84, 97]. In one study, based on survey responses from 182 colleges and universities, provision of stop-the-clock policies was more common among doctoral and comprehensive universities than baccalaureate colleges [123]. Both women (35 percent) and men (23 percent) were more likely to use the policy at doctoral universities, which may reflect the greater emphasis on research productivity in tenure decisions at these institutions [123]. In a study of queer women faculty, Stygles found that one woman was discouraged from taking the

tenure-stop policy, which she thinks reflects that she did not give birth, even though she was equally involved in care [4]. Some research on faculty in four fields at a range of educational institutions suggests that while men and women who use stop-the-clock policies are not disadvantaged in terms of earning tenure, women who use the policies take longer to be promoted to full [124]. While in some cases, institutions may backdate any salary increases associated with tenure to the original tenure date to eliminate any financial impacts of stop-the-clock policies, this is relatively unusual [109, 118]. When taking leave related to the birth of a new child, these policies may be gender neutral or may be focused on women (due to increased caregiver responsibilities; earlier iterations of the policies tended to be focused on women but gender-neutral leaves are increasingly being adopted) [120].

Parental leave and care leaves are another key policy [2, 16, 38, 44, 84, 121, 125]. In some cases, faculty receive one or two semesters of paid leave or modified duties, due to the birth or adoption of a new child, or receive paid leave to care for a family or household member, though in others, faculty receive little to no paid leave. In one study of 87 medical schools, 72 percent offered paid parental leave for birthing parents, but only 15 percent offered at least 12 weeks of paid leave, with median leave for all institutions at only 4 weeks [125]. One-third of institutions required birthing parents to use vacation leave, sick leave, and disability leave [125]. Only 13 percent of institutions offered at least 12 weeks of paid leave for non-birthing parents, with 3-week median leave for non-birthing parents [125]. In her study of queer faculty mothers, Stygles found that they were less likely to be offered or take formal paid leaves, instead taking informal leaves or modified duties [4]. When paid, these policies can be important to STEMM faculty, since the United States does not have a federal paid leave program (although most faculty are eligible for unpaid FMLA), and many STEM faculty are not able to take unpaid leaves [84].

Leaves can help ensure that faculty women are retained by the university, as substantial research shows that employment rates are higher for women with access to paid leave [16]. Importantly, leaves should be made automatic, so that faculty have to act in order to forgo the leave rather than receive the

leave, as this reduces flexibility stigma [38].⁴ As Ward and Wolf-Wendel argue, “An opt-out approach sends the message that the institution expects faculty members to use the policies that are made available to them.” Modified duties policies might reduce a faculty member’s teaching or service load, as opposed to releasing faculty from all teaching and service [84, pg. 214].

Colleges and universities, or funding agencies, can also provide additional funds to continue employing STEM faculty’s research personnel when they are on leave—helping keep the science moving forward [14, 38]. Research done at a research-intensive university in the Northeast suggests that many faculty—by letting go of service and teaching responsibilities during parental leaves—are able to maintain their research portfolio [126]. O’Meara and Campbell similarly find that women who took leaves and tenure clock stoppages allowed them to continue their research part-time, noting that without the leave, “they either would have had to quit, request a leave of absence, or fail to receive tenure and promotion” [122, pg. 470]. Yet, due to cultural expectations and flexibility stigma, faculty may be penalized if they take care leaves or tenure stoppages, and thus education of their colleagues and supervisors is critical [107, 127].

Providing either subsidized on-campus childcare or subsidies or grants aimed at reducing childcare costs is another important set of policies [2, 14, 16, 38, 84]. Childcare is extremely expensive, particularly for young children, and often unaffordable for STEM faculty (as well as students and postdocs), particularly those with student loan debt. In one study of biologists, physicists, and astronomers, one-third of those interviewed called for affordable university childcare as key, because it allows them to spend less time commuting and creates less unexpected childcare disruptions [38]. In a large-scale study of academics across different institutional types, the researchers note, “Across the board in our study, we learned that finding affordable and accessible daycare was a major challenge for faculty with children” [84, pg. 220]. While some universities provide on-campus childcare options, those options may not be subsidized for faculty, matching prevailing market rates in the area, or may not be accessible,

⁴ Cech and Blair-Loy define “flexibility stigma” as the penalties workers experience when they take care-related workplace accommodations [137; see also 98 and 143].

with too few childcare places, given demand [14]. Some institutions also provide backup and emergency care, including for sick care, snow days, or other times when children's schools and childcare are closed [2, 16, 38]. Universities can also increase access to summer camps for faculty children [2, 16]. Support for eldercare and care for the disabled can be another important policy, and some institutions provide at least connections to care for family, children, and pets [14, 16].

Another support focuses on funding for childcare for conferences, providing grants that allow STEM faculty to either pay for childcare costs at home, or at conferences, or subsidizing care costs, allowing these faculty to present their work and engage in critical networking with other STEM researchers [14, 16, 20, 38, 44, 99, 100, 128–132]. In one study based on full-time faculty at a large research university, at least half of the faculty with children noted that lack of childcare meant that they were unable to plan or attend research-related travel, submit to a conference, or accept an invitation to give a talk; this effect was stronger for those faculty who were partnered with another academic [130]. Those hosting conferences can further allow children and babywearing and provide spaces for pumping and breastfeeding [99]. Conference-related financial support may be provided by colleges and universities, be allowed in grants by funding agencies, or be subsidized by disciplinary societies [14].

Another approach can be providing flexible funds aimed at caregiving faculty. For example, Smith et al. call for a flexible funding opportunity for all primary caregivers, allowing them to use funds that ensure that their research productivity is not interrupted unnecessarily [133, 134]. They suggest using the award to hire additional staff for faculty on leave, for example. Federal granting agencies can further adopt policies to ensure that faculty with caregiving needs are able to take leaves and extend their grants while also providing funds for childcare or replacement of faculty or project staff on care leaves [14].⁵ For example, some institutions provide extra financial support for research personnel when faculty members have small children [14]. San Martin et al. further note the importance of ensuring faculty

⁵ See <https://www.nsf.gov/career-life-balance/>.

insurance covers family planning, labor and delivery, and prenatal and postnatal treatments, and a range of supports from after school tutoring to lowering college tuition and fees [2].

A range of supports, such as a website that lists all of the institution's care policies and supports, coupled with family resource officers, who help faculty with children navigate their family's care needs, can make a difference to caregiving faculty [16, 38, 84]. One large-scale interview study found that most institutions either have no or limited policies, have policies but faculty are afraid to use them, and have policies but only a limited number of faculty use them [84]. Clear communication about care support can help address flexibility stigma and make it more possible for faculty to access policies. Other supports, such as lactation rooms distributed across campus, also can create a more welcoming culture [16].

Fostering family-friendly cultures in departments, where colleagues and department chairs encourage faculty to take advantage of family resources and support are also important [16, 38, 90, 135]. In addition to work-family organizational support, support from supervisors, such as department chairs, are key [84, 90, 135]. Ideally, supervisors should further recognize the particular demands on mothers of color, given parenting's intensified challenges [110, 136]. These strategies can help address the flexibility stigma that may occur when STEM faculty take advantage of care policies or the challenges that occur when faculty do not take policies that they have a right to take due to bias avoidance [38, 98, 104, 137].

Scheduling talks and meetings early or late in the day reflect cultural schemas that faculty (as well as postdocs, staff, and students) do not have care responsibilities [96, 107]. In an interview study of men faculty members at four institutions (in the West, Midwest, East, and South), many fathers noted the challenges of early morning and late evening meetings [96]. By ensuring that most important meetings, such as faculty meetings, and talks are conducted during the school day, more STEM faculty members are able to attend these meetings and talks, and engage with their colleagues [14, 16, 84]. Where, for example, meetings and talks are held late in the day, STEM caregiving faculty find themselves at a disadvantage. Allowing faculty to identify teaching schedules that allow them to manage their care responsibilities also are important [16].

Flexible work policies that allow STEM faculty, for example, to work from home if they are in commuter relationships or when schools or childcare is closed, or bring children to the office when necessary, also can benefit STEM faculty with care responsibilities [14, 38, 98, 138, 139]). Yet, of course, flexible work can also have unintended consequences, intensifying the workday as work becomes home [98]. Research also suggests that flexible work can weaken social relationships with coworkers, which can be important to career success, though it may also allow for disconnection from negative interactions with coworkers [140].

Given that STEM faculty, particularly STEM faculty women, may be partnered with another faculty member or professional worker, some colleges and universities provide dual-career hiring policies, which make it easier for both partners to find employment at the same institution or in the same area [44, 84, 98, 138, 139, 141, 142]. In one survey given to chief academic officers at institutions affiliated with the American Association of Colleges and Universities, relatively few had written policies on the record, and these were more likely at research-intensive universities [142]. In addition, faculty were more likely to ask for accommodations regarding a partner hire when a policy was on the books [142]. Faculty were much more likely to be recruited successfully at institutions with dual-career policies [142]. Dual-career hiring policies were also particularly important for institutions located in more rural areas [142].

Dual-hiring policies can run the gamut from staff support for job hunting in the area to dedicated funding for hiring of faculty spouses or partners to allowing faculty partners to share a position [84]. Research done on nine faculty couples at AAU (Association of American Universities) universities in which both members are Black, Latine, or Indigenous, finds that women of color, in particular, appear to be more likely than men to leave positions or reject jobs for the sake of their partner's career, often accommodating their careers by taking non-tenure-track jobs [141]. Research conducted on 16 faculty couples at three large, public, research-intensive universities further finds that many members of these couples internalize stigmas around dual hires, and women, in particular, engage in substantial work to legitimize their presence [138]. Given that care demands are particularly intense for couples who are

commuting, these policies can be effective at addressing care responsibilities and can help retain STEM faculty who might otherwise leave the institution in search of non-commuting options.

Another policy is allowing STEM faculty to take part-time or other reduced work options. For example, tenure-track faculty could be placed on a part-time basis for up to 12 years if they have documented caregiving responsibilities for children, parents, or other ill family members. Although this policy also is tied to lower pay and benefits, as the work is part-time, by making the policy flexible, it allows faculty with particularly intense caregiving needs to continue their careers [84, 97]. This has been implemented with both permanent and temporary variants at research-intensive universities [97].

Scientists in the large-scale study of academic faculty in physics, astronomy, and biology noted that they would like tenure-track positions to allow time off or part-time options [38, 121]. Ecklund and Lincoln suggest opportunities for faculty to work part-time for up to 5 years, as needs arise, while also guarding against any penalties such faculty would face for gaps on their vitas [38]. A half-time faculty tenure-track option, for example, might allow tenure-track faculty to have their work reduced by half during periods of intense caregiving, while also allowing faculty to continue making progress toward their goals [44, 84, 121]. An increasingly important policy focuses on reconsidering promotion criteria and how it reflects STEM faculty workload.

Cultural Solutions

If cultural schemas—such as work devotion, the ideal worker norm, and what constitutes excellence [54, 143]—continue to hinder the implementation and usage of family-friendly policies, then cultural solutions must be an integral part of work-life inclusion efforts. In their review, Williams et al. argue that the psychological significance of how identities are constituted by and through work is not given enough attention in work-family research [143]. Specifically, they see resistance to flexible work policies as one “fueled by identity threat”; that is, work is often so intimately tied to identity that efforts to reform the hegemonic culture of (over)work can be threatening to those who developed their identities around the original model (of the ideal worker) [143]. In a study of 305 elite women professionals in a

science and technology cluster in California, women that most closely embraced the work devotion schema experienced less feelings of overload compared with women who did not, net of hours and work or family conditions [53].⁶ This finding indicates the power of the cultural schema to construct working long hours as justifiable, and perhaps, even expected on the individual level, while also gesturing toward the potential for such adherence to have “knocked-on effects” [144], or setting the standard that colleagues in less secure positions must also follow.

Although family-friendly policies and flexible work options have gained some attention and traction (especially in the time of COVID-19), work-life initiatives remain on the peripheries of organizational discourses and strategies rather than as core dimensions of academic culture [98, 135, 145]. As Kossek et al. write, “work-life changes ... [need to be] part of the core employment systems to enhance organizational effectiveness and not just as strategies to support disadvantaged, non-ideal workers” [135, pg. 3]. Rather than an addendum, work-life inclusion must be foundational to the creation of university policies, in order to help dismantle cultural models of work and redefine academic excellence and success with flexibility in mind [54, 135, 145]. Communicating clearly about all policies, and the expectation that caregivers take advantage of these policies, is key [84]. Thus, chairs and deans must receive consistent training about existing policies and how to implement them, and faculty should be informed about all policies related to caregiving, and where to go for more information, at faculty orientations as well as each semester [84, 107, 127]. Without transparency and accountability, cultural schemas (read: the status quo) prevail, along with the accompanying biases that negatively impact the health and well-being of individuals and the state of scholarship and innovation more broadly [146, 147].

Accordingly, scholars have called for a range of strategies—individual, departmental, and institutional—that target the organizational culture of higher education. Recently, in response to the disruptions engendered by the pandemic, advice on and approaches to CV framing have circulated [148,

⁶ Though, as mentioned earlier, the effect of the work-devotion schema on feelings of overload is moderated by motherhood of young or school-aged children. In other words, even if mothers share similar understandings about work as their childless or older-parent counterparts, they do not experience the same decreased feelings of overload.

149]. Offering a simple, individual-level strategy, Arora et al. propose the “COVID-19 CV Matrix” as a potential framework for documenting contributions, disruptions, and caregiving responsibilities during the pandemic to aid in fair evaluations from tenure and promotion committees [148]. Specifically, a sample matrix might consist of three columns, listing categories (e.g., research, education, media), activity (e.g., halted, prep for online transition, op-eds) and descriptions (e.g., reported to organization, summer research course, *New York Times*), respectively.⁷ However, criticism of the matrix arose for diminishing the gendered and racialized impacts of the pandemic, including on caregiving and service responsibilities [150]. Seeking to address these concerns, Raja et al. have created a “CovidCV prototypical system,” which “creates a color-coded CV from the user’s data entries documenting work and home life” [149, pg. 1]. Specifically, users can document academic successes and setbacks; family events, such as birthdays; and ongoing struggles, such as the caring for a loved one—marking each entry as major or minor, good, bad, or neutral, and the feelings or emotions over the course of a given week [149]. The goal of this system is to provide “the underlying ‘invisible context,’” by illuminating the conditions, events, and struggles that affect each faculty member’s ability to work and live in a holistic way [149, pg. 1].

In addition to individual-level efforts, research has also the importance of meso-level interventions and everyday workplace supports for fostering equity and inclusion in academic environments [84, 98, 151]. For example, Kossek and Lee examine how work-life issues intersect with gender and affect women’s career advancement (focusing on the business school context) and recommend actionable steps for leaders [98]. Specifically, they highlight the importance of “work-life boundary control,” or the ability to control the separation, integration, and salience of particular work and nonwork roles to avoid role conflict or strain [98, pg. 9]. Actions that can aid in this boundary management include scheduling meetings and events with family responsibilities in mind (i.e., from 9 a.m. to 3 p.m.),

⁷ For matrix examples, please see https://www.exploretthespaceshow.com/white_papers/covid19-contributions-on-a-professional-cv/.

encouraging email breaks and vacations, celebrating egalitarian caregiving efforts, and recognizing nonwork achievements [98]. Notably, these suggestions are feasible and can be enacted in programs, departments, and colleges to target academic organizational cultures by placing work-life inclusion at the forefront.

When crafting caregiving support policies, universities must assess how these policies interconnect to existing policies on campus. In some cases, campus policies contradict one another in ways that may deter usage. For example, many campuses have child-*un*friendly policies in place that prohibit children from being on campus at all except in exceptional circumstances [103]. As just one example, the University of Connecticut's policy written in 2013 specifies that faculty wishing to bring their children to campus (for brief visits only, not to exceed 2 hours) must notify the dean or chair in advance and receive written permission, and they are warned that the child must not disrupt the environment or "negatively impact productivity." Furthermore, any violations of these parameters "may result in appropriate disciplinary measures."⁸ Even if these universities and colleges offer parental leave and other family-friendly policies, faculty may feel uncomfortable trusting that their decision to prioritize their child for a semester in an institution that seems otherwise so hostile to children will not be held against them. Indeed, research shows that faculty look for symbolic evidence that campuses truly are family friendly. One study finds that visibility of children on campus is one of the most important symbols for faculty in determining whether they will be stigmatized for utilizing family benefit policies or not [152].

Cultural solutions can also be implemented at the institutional level, especially through efforts to change leadership in order to engender cultural change [145, 147]. In fact, in 2013, Valantine and Sandborg called for 50/50 leadership representation among women and men in academic medicine by 2020, arguing that closing the gender gap in leadership would help to usher in improvements in work-life

⁸ See <https://policy.uconn.edu/2015/04/20/children-in-the-workplace/#:~:text=The%20child%20must%20remain%20under,not%20allowed%20in%20the%20workpl ace.>

integration and flexible work options [145]. Though gender parity in academic leadership in science and medicine has yet to be achieved, Valentine notes its continued importance as a “seed [for] the cultural change necessary for inclusive excellence,” and documents the system-level strategies that have been implemented in the NIH’s intramural research program (IRP) to foster an organizational culture of inclusion and equity [147, pg. 1475]. The NIH’s four integrative strategies include having an equity committee to track metrics of diversity and inclusion; diversifying candidate searches beyond personal, informal networks; providing bias educational training for all search and promotion committees; and establishing the Distinguished Scholars Program of roughly 15 tenure-track investigators with commitments to inclusive excellence [147, pg. 1477]. Uniting the components of this plan is the common goal of changing the institutional culture of academic medicine through the increased representation of women and other underrepresented groups.⁹ Such strategies for cultural change can be used as a model for other institutions and will also lend support to individual actions (such as CV framing), as well as departmental or college-level efforts (such as work-life boundary management).

Unanticipated Consequences and Barriers to Existing Policies

A number of policies have been put into place by universities and colleges over the last few decades in an attempt to address the challenges we have laid out above. This includes some level of paid parental leave or “modified duties” around the birth or adoption of a young child, though it should be noted that these policies are not provided consistently and may even be at odds with state and federal laws [97]. Despite becoming more common at colleges and universities, less than half of institutions offer these benefits [153]. “Modified duties” policies may release faculty from some or all teaching and service responsibilities, while parental leave is more likely to refer to cessation of all work activities. But the

⁹ At the time of the article’s publication, women comprised 45 percent of the NIH IRP tenure-track investigators (up from 36 percent in 2013) and individuals from underrepresented racial and ethnic groups comprised 13 percent (up from 6 percent in 2013) [147, pg. 1477].

most commonly offered benefit is pausing the tenure clock for a year to account for time spent caregiving upon a birth or adoption [154].

Despite significant ongoing gender inequalities, over the time that these policies have been introduced, the motherhood publishing penalty has diminished [153]¹⁰ and the leaky pipeline has shown some signs of repair, at least at the earlier stages of women's STEM careers [155]. However, the connection between institutional caregiving policies to improved productivity and faculty retention outcomes has not been rigorously established. Very few studies have been done to systematically assess the impacts of leave and caregiving policies on faculty careers [16, 120, 156]. This is due, in part, to the fact that there are no publicly available, centralized, and/or standardized data sources on existing higher education family policies. The information available is often voluntary reporting out by individual institutions, usually when a policy is first implemented. Data that tracks such policies and how they may change over time is even more challenging to find. Given that family-friendly policies are often adopted also as recruitment tools in competition with other universities for the same pool of faculty, institutions have little incentive to publicly report policy challenges and failures. Thus, analyses of policy impacts tend to be drawn from single sources, usually scholars analyzing cross-sectional data from their own institutions.

As a result, existing policy data are rarely representative of the overall higher ed landscape, and since even single institution-based data collection is rarely done before and after policy implementation, average take-up rates and overall impacts of higher ed caregiving policies on caregiving faculty's careers remain largely unknown. These caveats aside, we identify four primary barriers to successful policies based on the few studies that have been done. These are (a) challenges in implementation; (b) gender neutrality, where equally distributed policies carry unequal impacts; (c) financial cost, where the university may offer a policy but at a high (unsubsidized) cost and/or with limited accessibility; and (d) flexibility bias, where cultural norms have not adjusted to policy norms (e.g., cultural lag). Such

¹⁰ Although the gender gap in publication has increased [see 33].

unintended consequences reflect problems in policy design, and we point to alternatives that might be more effective and less likely to reinforce inequalities by gender and caregiving status where relevant.

Implementation Challenges

Where institutions have adopted policies aimed at supporting caregivers there remain a number of hurdles around implementation. Communication of policies is a central problem, as is training of chairs, deans, and other administrators in what policies mean. In too many cases, faculty report a lack of response or suggestions that if they take existing policies, it will disadvantage their careers [97, 127]. For example, in one study of queer faculty mothers, faculty members reported concern about unofficial concern from some administrators for being a lesbian adoptive mother taking leave, while a foster parent was not offered any leave [4]. Faculty should not be in a position of negotiating support that already exists. Without adequate training, adopting policies are ineffective. Yet, as Culpepper and Kilmer find, less than 5 percent of institutions who had put “pandemic impact statements” into place also provided training for faculty and administrators who would be evaluating faculty who used such statements [119].

One study focused on STEM faculty at a university that had a policy allowing mothers 240 hours of paid parental leave and fathers 120 hours of paid parental leave found challenges in taking a short-term leave while teaching, given the length of the semester [157]. Many faculty also noted that they continued working even when they were officially on leave, given the need to stay in touch with their labs and students [157]. At the same time, there were challenges with lack of knowledge of the policy and how it worked among the administrators implementing it [157].

Another study examines faculty at a midsize Canadian university, who have statutory entitlements for 1 year of job-protected leave, 17 weeks of pregnancy leave for birthing parents, and 35 weeks of parental leave for parents, at a benefit rate a little more than half of normal income, with many workers receiving supplemental benefits through employers [158]. Despite the clear laws, faculty describe the confusion and lack of procedure around their leave, with faculty asked to use course releases for the leave or teach additional classes when they returned from leave, ask colleagues or grad students to take

over their courses in the middle of semesters pro bono, and other “creative” solutions [158]. The researchers further analyzed collective bargaining agreements across a range of Canadian universities, finding inconsistencies across universities, as well as expectations that go against the leave entitlements (such as expecting faculty to “make up” courses) [158].

Another study based on a survey of 182 colleges and universities found that at many institutions there was a lack of clarity in how stop-the-clock policies were treated [123]. For example, 60 percent of doctoral granting institutions note that tenure review committee members are told to “use their own judgment” in how to consider stop-the-clock in making evaluations, while 33 percent were told to treat the candidate as if they had completed a normal probationary period, and 6 percent were told that they should evaluate candidates based on total years worked [123, pg. 87]. These differences in implementation could likely lead to very different outcomes for candidates who took tenure leave stoppages.

Gender Neutrality

Gender-neutral policies are aimed at supporting both women’s and men’s caregiving responsibilities, reflecting analyses of STEM faculty that suggest that both men and women have concerns about combining STEM careers with care [38, 85]. In countries that adopt leaves that are reserved for fathers, research shows that—over time—men are more likely to participate in care for children as well as for domestic work, and motherhood penalties in wages are smaller [159–162]. While some institutions offer leaves only to parents who give birth, gender-neutral policies have also been adopted at institutions to address gender inequalities in STEM fields, but evidence about their efficacy is mixed.

Gender-neutral policies have come under criticism for potentially reinforcing an unequal status quo by maintaining or even exacerbating the gender gaps they were meant to address. Tenure clock stoppage policies are one notable example. The most common family policy at universities, they are usually offered upon childbirth or adoption, regardless of whether the faculty member takes a care leave.

A study of economists over the period 1980–2005 at the top 50–ranked U.S. departments finds that the implementation of these policies resulted in a widening of the gender gap in tenure. Stopping the clock increased short-term tenure rates by 17 percent for economist men, while reducing women’s tenure rates by 19 percent [120]. However, over the long term, these policies do not reduce the probability that either women or men earn tenure in the profession [120]. Antecol et al. also found a correlation between clock stoppage and publication in top-5 journals for fathers at top-ranked departments with no discernable increase for women, suggesting that men economists in elite departments are able to use their extra year for career advancement in addition to or in place of caregiving [120].

However, this may not play out in other disciplines or at a wider range of institutions. For example, another study of all faculty at a single R1 found no difference in publication rates between faculty who took a delay versus those who did not, nor any gender differences in productivity or promotion rates among those who stopped the clock [156]. However, they found a pay penalty for faculty who took the delay when the delay was used for family-related reasons. Manchester et al. suggest that the pay penalty reflects these faculty members’ violation of “ideal worker” commitment norms [156]. They note that even 4 years later, men who took the tenure delay had lower salaries, although women’s salary penalty dissipates, perhaps because men’s commitment to family is particularly stigmatized [156]. These findings may also reflect the inability of caregiving faculty to go on the job market to secure competitive counter offers. Other researchers similarly suggest that men who are involved in caregiving may face particularly stiff penalties [127]. As Williams et al. argue: “Because of . . . stereotypes, men seeking an active role in caregiving and family life may face an even chillier climate in academia than women, who at least have pregnancy and birth to justify any time off” [127, pg. 87].

In another study using surveys and interviews conducted at a research-intensive university in the Northeast, the researchers explicitly examine faculty use of leave, including the possibility that men take leave to spend more time on their research [126]. Faculty mothers (72 percent) were more likely to take leave than fathers (18 percent), though the benefit was gender neutral. In interviews, non-leave-taking men explain that they worried about their colleagues’ perceptions of their commitment to work if they had

taken the leave [126]. At the same time, faculty in STEM fields (26 percent) were also much less likely to take the leave compared with all faculty (61 percent), with STEM interview respondents worrying that taking leave might lead to research “gaps,” noting that their departments are not family friendly. Both men and women who took leaves primarily had full-time working partners or partners who could only take temporary leaves. The three respondents who took the leave despite having a partner who was a homemaker or working part-time were all women. Thus, men did not appear to be taking leaves while a partner provided care. In addition, many of the respondents—both women and men—who took leaves describe not a complete cessation of work but describe instead how leave allowed them to cut back on their work to provide care, while still spending a little time on important, time-sensitive work, such as mentoring and research.

During the pandemic, most universities extended tenure clock stoppage universally to pre-tenure faculty, *regardless of gender or parental status* [119]. Although it is too soon to measure the long-term impacts of this policy, studies have already indicated that the pandemic had differential impacts on parents of young children and was particularly devastating for mothers. A study examining pandemic tenure-clock-stop policies among STEM and non-STEM at an R1 and an R2 institution finds that minoritized faculty in all fields and women in social science fields were more likely to take tenure delays [163]. They note that the policy may perpetuate the gender gap, concluding, “We contend that when faculty issues being addressed by campus leadership are not gender-neutral, then the policies ought not to be gender-neutral either” [163, pg. 887]. Culpepper and Kilmer suggest that it would be better for institutions to reconsider tenure expectations, given that it is not clear how long it might take faculty research to “recover” from pandemic interruptions [119].

There is also indirect evidence from a longitudinal study of R1 computer scientists, historians, and business professors that gender-neutral parental leave impacts mothers and fathers differently. Although the gendered academic productivity gap has closed over time, it is due entirely to women’s increased productivity levels [153]. Even though men have become more engaged in fathering over time [164], and faculty paternity leave rates have doubled since the year 2000, there has been no discernible

decline of fathers' academic publishing rates [153]. But neither has there been an *increase* in fathers' productivity upon leave-taking, as might be suggested by Antecol et al.'s study on men's advantages from use of stop-the-clock outcomes [120].¹¹ This suggests that parental leave compensates men for their increased caregiving participation while failing to fully compensate women for the often greater intensity of maternal caregiving (which often also includes physical aspects of reproduction and lactation) and disproportionate demands on women in the raising of a child.

These findings raise the importance of universities providing more nuanced policies that are sensitive to identifying the vulnerable populations they seek to support. There is no reason why policies cannot differentiate between primary caregivers and secondary caregivers in terms of paid time awarded. Policies should also take into account the labor of reproduction and lactation. Like any other process, for example, sabbatical usage, universities can put simple accountability mechanisms into place to ensure that those who receive the benefits are able to use the benefits as intended. Yet, as Lundquist et al. argue, it may be counterproductive simply to limit parental leaves and tenure clock stoppages to women, as the more men engage in care, the more likely cultural norms around caregiving and work will shift, allowing more caregivers of all genders opportunities to maintain employment, as well as engage in care [126]. Some universities have explicitly designed leave policies to target those providing substantial care. In 2008, Williams and Norton noted that Stanford and Harvard faculty could reduce their teaching if they were the sole caregiver for a new baby for at least 20 hours during standard working hours; these policies were aimed at ensuring that faculty who take leave are actually providing care [97].

Costs

The United States' weak welfare state [165] has long meant that families carry the burden of care. In other countries, families receive subsidized or free childcare, health care, housing allowances, and child allowances meant to help address the additional costs of raising children. Care is costly. It is

¹¹ Other researchers find that the stigma around men using family leave policies mitigates against abuse of the policy and results in significant numbers of men not taking leave even when they need it [126].

primarily women who bear those costs in terms of their careers and economic well-being. If STEM fields are dedicated to addressing the equity gap, academic institutions must commit to doing more to help families carry the cost of care, both in terms of providing appropriate resources and in terms of making a case for public financing of care labor.

Some institutions have taken on additional costs in their provision of paid parental leave, given the lack of a federal policy for paid leave. These paid leaves or efforts around “modified duties” may be a few weeks, a semester, or in some cases, two semesters for a birthing parent. For STEM faculty at institutions that do not provide paid leave, most faculty simply try to time births around semester breaks, and manage care needs without additional supports, often focusing their limited time on time-sensitive duties such as teaching and service commitments.

Thus, paid leave is a necessary step, but on its own, is still insufficient. Offering paid parental leave allows faculty to navigate the immediate contingencies of childbirth; however, a few months is a fraction of the time required to raise a child. As such, some universities also provide subsidies for childcare, either provided directly by the institution or by making outsourced care more affordable, allowing faculty with caregiving responsibilities to both remain employed at the institution and thrive in their careers [110]. Ideally, universities would also provide on-site backup childcare [43]. However, no representative survey of colleges and universities has assessed how many campuses provide childcare subsidies or on-site care. We know that it is rare among private U.S. employers to offer on-site childcare (about one-quarter of large corporations do so) [166], and anecdotal reports suggest that it is equally rare in academia. However, recent surveys of specific academic fields suggest the number may be higher than thought; for example, 62 percent of academic medical centers and 72 percent of universities with public policy schools provide some degree of on-site childcare [167, 168]. Nevertheless, such existing childcare for faculty on college campuses is rarely subsidized,¹² and the cost often exceeds what the U.S. Department of Health and Human Services designates as affordable given the average faculty salary

¹² In fact, some programs are designed with faculty rates that are high enough to subsidize the costs for students.

[168]. Moreover, when on-site care is available, full-time slots are not always offered, and since childcare centers tend to exist mainly at large public universities, they are largely unable to meet the overwhelming demand from faculty, staff, and student populations [168–170]. Furthermore, some research shows that nonacademic Black mothers may prefer to utilize other forms of childcare, such as kin-care or community care centers [58, 136]. This further speaks to the importance of making on campus care and/or off campus subsidies more affordable.

Very few evaluations have been conducted on the impact of existing childcare policies. Two studies examine single settings (in one a southern university, the other an academic medical center) and compare attitudes of employee parents who utilize on-site versus external childcare. In the first they find no difference in work engagement or work satisfaction (except where childcare was perceived as poor or motivated for the wrong reasons, in which case on-site users showed less engagement and satisfaction with the university), while the other found a significant reduction of reported stress by on-site users [169, 170]. In both cases, childcare was not subsidized and each had extensive waiting lists. Clearly, more studies are needed.

There has also been some movement on the part of professional associations and granting agencies to account for caregiving needs. For example, some professional associations provide childcare services at conference meetings, but fewer are subsidized, and these costs are out of pocket for the individual. Since most universities do not allow faculty to use their research and conference funds to cover dependent travel or childcare costs, the expenses are often too high for faculty to afford. As discussed above, this results in a gendered caregiver gap in attendance at professional gatherings, which are the bread and butter for networking and perceived impact in the field. When stipends for childcare are made available, they are likely to be helpful. An evaluation study of 169 STEM faculty who had utilized a medical school's conference/travel childcare stipend of up to \$2,000 over 12 years finds that some respondents said it enabled them to attend the conference, and 20 percent reported that doing so had a positive impact on their research program and their potential for international impact [100]. Notably, there are financial constraints, but the study finds that by "limiting the awards, the program is highly cost

effective.” Ideally, these types of programs could be offered on an as-needed basis across all universities. Some fellowships and granting agencies have also begun to allow researchers to include very limited childcare costs in their budgets (e.g., \$2,500 for childcare over the course of a year for all children) [14, 130].^{13, 14} These programs are not consistently provided across the many foundations and agencies that fund STEMM research.

A longitudinal evaluation study of tenure, promotion, and retention among a representative sample of faculty, for example, parents who had regularly used childcare stipends and campus childcare programs compared with those who had not had access to such programs, would be a helpful way to assess the extent to which universities should invest in these programs. In addition, universities would do well to adopt paid caregiving leave policies at a higher level than the current state (less than 50 percent do so). This is expensive; however, it may be a cost savings if it means faculty that the university has already invested heavily in will remain at that institution in a successful tenured career. Studies of the nonacademic workforce tell us that women who receive paid leave are more likely to return to work and to do so sooner [171]. Given the structure of academia, with tenure and promotion reviews often occurring during the most intensive caregiving years, such programs are likely to be even more impactful among university professors.

Finally, one of the reasons why tenure clock cessation is the most common family support policy adopted by universities is because it is costless. In fact, it is a cost savings to the university, but one that is shouldered by the faculty member who forgoes a year or more of their post-tenure salary and a longer period of vulnerability without the protections of tenure. This will only exacerbate existing gender salary gaps in the academy given who is most likely to opt in to the policy. Indeed, one analysis of faculty at a research-intensive university in the Midwest finds that faculty are less satisfied with the tenure process if they took a tenure delay [172]. When universities were forced to innovate during COVID-19 with many

¹³ See <https://finance.uw.edu/gca/award-lifecycle/sponsor-specific-information/nih-childcare-allowance>.

¹⁴ See <https://www.nsf.gov/career-life-balance/> and https://grants.nih.gov/grants/policy/nihgps/html5/section_14/14.10_allowable_and_unallowable_costs.htm

offering tenure delays to all faculty regardless of caregiving status, some provided a pay raise retroactive to when faculty would have otherwise received tenure, which helps mitigate the delay's financial impact on faculty [173]. Some universities seem willing to compensate faculty when the context is seen as outside faculty members' control (e.g., a pandemic), whereas family making is still seen by the university through the lens of individual choice. This perspective only widens the gender gap. Offering retroactive pay raises to those who delay tenure for caregiving specifically would be an effective way to bridge the gendered pay gap in academia. Or, barring this commitment, devising innovative ways to use the cost savings of delay policies for subsidized childcare or other policies is another potential consideration.

Flexibility Bias

One of the biggest challenges with any introduction of new policies is ensuring cultural change to go along with it. Faculty who have taken advantage of family-supportive policies have sometimes experienced biased treatment and career penalties in the form of a lack of support from department chairs and colleagues, as well as retaliation in career assessments [23, 96–98, 127, 174, 175]. For example, Williams and Norton describe one lawsuit after a woman faculty member took parental leave and delayed her tenure clock:

Despite unanimous recommendation from her tenure committee and endorsement from the dean, she was refused tenure upon her return. The provost of the University of Oregon allegedly told another professor that the mother's decision to "stop the clock" was a "red flag," and the department chair wrote in a memo that Arkin "knew as the mother of two infants, she had responsibilities that were incompatible with those of a full-time academician [97, pg. 191].

Biased assessments affect men as well as women [96, 174]. In her study of faculty fathers, Sallee notes, “Over 25 percent of the sample shared stories about ways in which they or other male colleagues had been penalized for making use of accommodations” [96, pg. 798].

This makes it critical for institutions to not only adopt family-friendly policies but provide robust training to all supervisors in how to respond to accommodations [97, 109, 127]. Policies are only as good as their implementation, and since so many faculty are involved in implementing policies as well as evaluating colleagues, all parties need to be informed about exactly the policy should be implemented. As mentioned previously, though pandemic impact statements were adopted by a number of research-intensive universities, less than 5 percent of universities using them provided trainings in how to use them. Since these statements may, at times, refer to caregiving responsibilities, without training they could simply deepen existing inequalities [109]. Clear instructions for all those providing evaluations of faculty, including reviewers external to the institution, are also mandatory, ensuring that faculty who take leaves, or tenure clock stoppages, are not treated differently from those who did not [97, 109].

Although parental leave and tenure clock cessation are the primary ways that universities provide caregiving support, a small number of institutions have also put in place part-time opportunities or shared jobs for faculty with caregiving responsibilities. Flexible work scheduling norms have not made the same inroads into the academic setting as they have in some firms and corporations; however, such arrangements have made a major difference for the success of nonacademic employees [146]. As such, scholars have suggested variations within academia, such as the half-time tenure clock that operates on a 12-year track [44, 84, 121]. Certainly, the precedent of the pandemic has sparked a shift in the way that tenure delays are viewed and accepted. However, so long as standards for success in academia remain static, such as the quantity of publications and citation indices, caregivers who opt for these pathways, primarily women, will continue to fall behind in academia. And, indeed, faculty who have engaged in these practices have been similarly disadvantaged in terms of promotion and tenure [97].

These penalties fall under Cech and Blair-Loy’s description of flexibility stigma [137; see also 98, 143]. They find that men and women (measured separately) STEM faculty who use informal or

formal arrangements to balance care for their children are seen as less committed to their careers [137]. Similarly, Joan Williams identifies “maternal wall” bias, which “tends to be triggered at any point when maternity becomes salient—especially when a woman requests parental leave, stops the clock, or seeks a modified schedule” [174, pg. 97]. These biases are often exacerbated or complicated for women of color [175]. Despite the existence and usage of leave and caregiving policies, STEM mothers and fathers who experience this stigma are less likely to be satisfied at the institution, less likely to feel work-life balance, less likely to plan to stay at the institution, and more likely to be considering leaving academia for industry [137]. Furthermore, flexibility stigma creates a disincentive to use such policies at all, hence, uneven take-up rates among STEMM faculty and men [96, 126, 153]. Concerns about this stigma may be part of why most faculty members on modified duties or parental leave continue to engage in research and mentoring if they can [126].

University policy interventions must be accompanied by cultural change in order to be successful. Faculty may otherwise face situations in which take-up of existing policies turns into a negotiation with their chair or dean [97]. Perlow and Kelly note that offering flexible work options while the culture of the organization continues to emphasize work devotion is likely to reinforce flexibility stigma [176]. Rather than “accommodating” the need for flexibility, they argue for the need to “challenge the underlying cultural schema and the practices, interactions, and reward systems tied to that schema” [176, pg. 126]. Indeed, at Stanford, researchers have implemented the Academic Biomedical Career Customization plan for medical school meant to address both work-life and work-work conflicts [145]. Faculty members design strategies, with the support of their department chairs as well as professional career-life coaches, that consider work-life integration as central to career success, taking into account pace, workload, roles, and schedule predictability [145]. These plans are not set in stone, but regularly discussed and adjusted, as necessary. Such a strategy has the potential to lead to deeper-seated changes in the culture of academia.

Cultural change is challenging; however, the COVID-19 crisis put into motion a series of major shifts that challenged conventional practices in higher education. Indeed, some used it as an opportunity to recalibrate our approach to the standards we use to evaluate productivity and impact. During the

pandemic, a team of researchers called on the field to reinvent how academia evaluates success in tenure and promotion evaluation altogether, for example, advocating for the use of alternative impact metrics, such as “communication, community-based implementation, dissemination (e.g., Altmetric scores), effective mentoring, and advocacy work” [16, pg. 1369]. Yet while the pandemic was paradigm shifting in a number of ways, the innovations universities adopted failed to fundamentally change the criteria for tenure and promotion. In a study of pandemic policies, less than 1 percent of the top 386 U.S. universities modified their tenure and promotion evaluation expectations in some way (e.g., to note that quality over quantity would be considered for evaluation or that other duties besides research would be given more weight) [119].¹⁵ If modifications to tenure criteria could not be justified to account for a global catastrophe with universally recognized lifetime impacts, it will be an uphill battle to enact cultural change around evaluation expectations to address inequalities stemming from “everyday” caregiving.

CONCLUSIONS

In this review, we summarize what is known about the impact of caregiving among STEMM faculty. We began by reviewing evidence showing that women are less well represented at higher levels in academia and how caregiving responsibilities appear to be related to this underrepresentation. Next, we sketched the history of caregiving in the United States, and how it is imbricated with social inequalities such as class, race and ethnicity, and sexuality. We presented evidence about who, by gender, race, and age, is engaged in more caregiving based on nationally representative data, and then explored the same trends in research on faculty, including STEMM faculty. As the data shows, STEMM women and faculty of color are more likely to be engaged in substantial caregiving and are more likely to experience career disruptions as a result of care. The research we reviewed also suggests that a wide variety of STEMM

¹⁵ In addition, in the aftermath of the COVID-19 pandemic Indiana University–Purdue University, Indianapolis revised its tenure and promotion criteria to include formerly unmeasured DEI-focused research, collaboration, teaching, and service activities [179].

faculty also identify faculty careers as antithetical to raising families [38], suggesting that both the structure and culture of academia create challenges.

In the next section of the review, we further interrogated those structural and cultural inequalities. We explored the hierarchical, racialized, and gendered organization of most university settings, and how assumptions of an “ideal worker” with no caregiving responsibilities remain powerful, even in an academy where most workers have or will have some caregiving responsibilities. We analyzed both structural and cultural elements of this organization, including typical working hours, and a lack of consistent policies that would support caregiving, whether for children, partners, or parents, and lack of investment in the careers of caregiving faculty. We further analyzed ideal worker norms and how STEM faculty reflect norms of the importance of “work devotion.” We considered how the pandemic had particular impacts on the careers of caregiving faculty, given the lack of structural and cultural support at most institutions for caregiving.

We then reviewed the key policies that universities rely upon, primarily tenure delays as well as parental leaves, while cataloging other policies that some colleges and universities provide, such as additional funding for caregiving faculty, childcare, emergency childcare, childcare funding for conferences, flexible funds for caregivers, institutional resource officers and websites, scheduling and flexible work policies, dual career hiring, as well as part-time and flexible tenure-track options. In addition, we explored the ways policies could be implemented, including the importance of signaling broad support for caregiving accommodations and training leaders aimed at addressing cultural barriers by embracing inclusive excellence.

Finally, we explored the unintended consequences of these policies. For example, where policies are poorly institutionalized, with conflicting rules or lack of training for leaders, the implementation of the policy may make little difference to faculty. Another concern is when policies are written in gender-neutral ways and do not reflect gendered differences in caregiving; gender-neutral policies can be effective, but they may require caveats regarding, for example, engagement in caregiving. We also explored the costs of these programs, and the challenges that these create; for example, childcare

programs that are more expensive and/or less accessible than market care will not support faculty caregiving. And finally, we examined how these policies may lead to flexibility stigma, punishing faculty members who take advantage of caregiving policies.

Overall, we have provided a detailed summary of what is known, while also pointing to the limitations of existing data on institutional policies. While the literature we cite generally refers to STEM faculty, or faculty more generally, or focuses specifically on medical faculty, our overall impression suggests that STEM and STEMM faculty experience many similar challenges. There is somewhat more literature that considers funding challenges and conference travel for caregiving medical faculty than for other elements of the faculty career, but this may be due to the central importance of funding and conferences to success in the field. Importantly, evidence suggests that medical school faculty have high levels of caregiving responsibilities, perhaps signaling that these faculty are more likely to be drawn into care for extended family members, due to their expertise. Thus, policies aimed at caregiving faculty are as crucial, if not more so, at medical schools.

We recognize the limitations of our analysis, yet we hope that this review provides evidence for the importance of institutional efforts to address both structural and cultural challenges for caregiving faculty. Caregiving is deeply connected to a variety of intersectional identities, including gender, race, sexuality, and class background. To truly create an inclusive academy will require creating support for all caregivers. Rather than an “extra” perk, care supports should be part of the central architecture of academic institutions, recognizing that the vast majority of faculty members are engaged in some form of caregiving, and that investing in their career success creates a stronger, healthier workforce.

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