

Sacrifice: Messages STEM Postdoctoral Scholar Women Receive about Career and Family

Sylvia L. Mendez (Professor/Chair)

Dr. Sylvia Mendez is a Professor and Chair of the Department of Leadership, Research, and Foundations at the University of Colorado Colorado Springs. She is engaged in several National Science Foundation-sponsored collaborative research projects focused on broadening participation in STEM academia. Dr. Mendez's research centers on the creation of optimal higher education policies and practices that advance faculty careers and student success, as well as the schooling experiences of Mexican-descent youth in the mid-20th century.

Kathryn Watson

Kathryn is a doctoral student at the University of Colorado Colorado Springs. Her work as a graduate research assistant for the National Science Foundation Alliance for Graduate Education and the Professoriate focuses on diversifying STEM education.

Valerie Martin Conley (Dean)

Sacrifice: Messages STEM Postdoctoral Scholar Women Receive about Career and Family

Abstract

An instrumental case study (Stake, 1995) explored the messages STEM postdoctoral scholar women receive about balancing an academic career with a family. Concerningly, women with children are less likely than men with children, or women and men without children, to be offered tenure-track positions or to be promoted (Bird & Rhoton, 2021; Cech & Blair-Lory, 2019; Gregor et al., 2021; Williams & Ceci, 2012; Ysseldyk et al., 2019). This reality suggests that motherhood is in opposition to professional legitimacy in academia (Hill et al., 2014; Thébaud & Taylor, 2021). Furthermore, postdoctoral scholar mothers are more likely than their peers to cite children as their primary reason for not entering the faculty job market (NPA ADVANCE, 2011). Interviews were conducted with 22 demographically diverse STEM postdoctoral scholar women to explore how messages about balancing career and family are considered. Using inductive and deductive methods (Silverman, 1993; Stake, 1995), interview transcripts were analyzed using the ideal worker conceptual framework (Kossek et al., 2021). Two themes arose: (1) STEM postdoctoral women receive messages suggesting they must sacrifice family pursuits for an academic career, and (2) positive modeling and support for balancing career and family are vital for retaining STEM postdoctoral women in the professoriate pathway. These findings illustrate a systemic conflict for STEM postdoctoral scholar women. They describe a necessity to sacrifice family desires, yet positive modeling and support for balancing career and family send messages suggesting it is possible to plan for both. This research is sponsored by the National Science Foundation (NSF) Alliance for Graduate Education and the Professoriate (AGEP; award #1821008).

Introduction

While pursuing a career as a professor often is identified as the single most valued career option among science, technology, engineering, and mathematics (STEM) postdoctoral scholars (van der Weijden et al., 2016), the path to the professoriate can be daunting for women who plan to have a family which influences career pathways (Bird & Rhoton, 2021). Negative messages cause women to depart the STEM professoriate trajectory, further reducing STEM faculty diversity, which remains primarily male. While balancing an academic career with a family has received attention in the literature, little has focused on the perspectives of STEM postdoctoral scholar women. An instrumental case study (Stake, 1995) is employed to explore the viewpoints of 22 demographically diverse STEM postdoctoral scholar women regarding the messages received about balancing career and family. The ideal worker conceptual framework postulated by Kossek et al. (2021) grounds the study to highlight the prized employee who prioritizes work over personal responsibilities and interests. The research question guiding this study is: What are the messages STEM postdoctoral scholar women receive about balancing an academic career and a family? This research was sponsored by the National Science Foundation (NSF) Alliance for Graduate Education and the Professoriate (AGEP; award #1821008).

Literature Review

While the rate of women obtaining doctoral degrees in STEM fields continues to increase, a lack of women in the STEM professoriate remains (Ahmad, 2017; Casad et al., 2020; Hill et al., 2014; Miller & Riley, 2021). Women make up 34.5% of STEM faculty in U.S. colleges and universities and only 28.2% of tenured STEM faculty (NSF National Center for Science and Engineering Statistics, 2019). Furthermore, although women account for 29% of the U.S. STEM workforce, disciplines have stark discrepancies (NSF, 2020). In life sciences and psychology, women represent half of the workforce but only 29% of physicists, 27% of computer scientists and mathematicians, and 16% of engineers. In an antiquated argument, this imbalance is said to be a result of men's greater aptitude in STEM, but this argument has been disproven time and time again (Bird & Rhoton, 2021; Kossek et al., 2021; Miller & Riley, 2021; Thébaud & Taylor, 2021; Williams & Ceci, 2012). Instead, a growing body of research documents that women depart academia for a host of reasons such as experiencing high rates of isolation, less support and fewer mentoring networks, tokenism, hiring and promotion discrimination, devaluing of their work, and sexual harassment (Bird & Rhoton, 2021; Casad et al., 2020; Ecklund & Lincoln, 2011; Gregor et al., 2021; Kahn & Ginther, 2017; Miller & Riley, 2021; Ysseldyk et al., 2019).

Often women in the STEM professoriate report choosing between a career and family. Women with children are less likely than men with children, or women and men without children, to be offered tenure-track positions or to be promoted (Bird & Rhoton, 2021; Cech & Blair-Lory, 2019; Gregor et al., 2021; Williams & Ceci, 2012; Ysseldyk et al., 2019). To combat these potential career consequences, some women report choosing to hide their families from their workplace due to fear their work will be devalued (Hill et al., 2014, Thébaud & Taylor, 2021). These realities suggest that motherhood is in opposition to professional legitimacy in academia (Hill et al., 2014; Thébaud & Taylor, 2021). Nevertheless, research shows that women with children are as productive as their childless peers (Ecklund & Lincoln, 2011). In fact, the highest faculty productivity rate can be found among assistant professors with young children (Ahmad, 2017). Additionally, any reduction in productivity due to child-rearing is temporary (Hill et al., 2014). Yet, women with children are less likely to be principal investigators on sponsored research projects, which could have long-term implications for their academic careers (Martinez et al., 2007).

Higher education institutions are seen as notoriously unsupportive of women with children since the professoriate was not designed to be compatible with having a family (Lee et al., 2017; Williams & Ceci, 2012). Instead, the professoriate tends to reward individuals who prioritize work above all (Kossek et al., 2021). Although Title IX and the Family Medical Leave Act were created to protect against gender discrimination and provide job protection for employees utilizing family or medical leave, many higher education institutions fail to deliver equitable policies to their faculty (Ahmad, 2017; Lee et al., 2017); for example, paid time off for family emergencies and maternity leave (Gregor et al., 2021). Of the institutions that offer maternity leave, few have adequate or supportive policies, leading women to feel they must return early or forego a break due to a concern these options could stall their research agenda (Bird & Rhoton, 2021; Gregor et al., 2021; Lee et al., 2017). While work-life balance policies received greater attention during the COVID-19 pandemic as parents in academia experienced increased pressure, females reported significantly more stress than their male counterparts due to the increased

demand to monitor their children's learning from home (Miller & Riley, 2021). Colleges and universities need to evaluate their family-friendly initiatives to ensure a healthier work-life balance is promoted, and gender bias does not undercut these efforts (Cech & Blair-Lory, 2019; Gregor et al., 2021).

Navigating career and family is challenging for women in the professoriate, but it can be even more precarious for STEM postdoctoral scholars. The average age of women in postdoctoral positions is 33, but optimal fertility begins to decline at 31, causing many women to feel they must choose between a career and a family (Williams & Ceci, 2012). The trade-off between career and family is apparent considering that 25% of women and 38% of men are childless between the ages of 24 and 30, but this increases to 75% of women and 65% of men in postdoctoral STEM positions (Martinez et al., 2007). In studies of postdoctoral scholars, nearly 50% of women reported that their postdoctoral position impacted their plan to have children and identified children as a top reason to leave the academic track (NPA ADVANCE, 2011). Additionally, postdoctoral positions often do not offer health insurance (Hoffman et al., 2009) or maternity leave (NPA ADVANCE, 2011). To counter this lack of protection, women in STEM time their child's birth to coincide with a school break or specific work transition in order to minimize time away from work (Bird & Rhoton, 2021). During their postdoctoral appointments, women with children are twice as likely as men with children to leave the academic track, citing too much pressure in academia and not enough time with family (NPA ADVANCE, 2011). This predicament has been dubbed the "baby penalty" (Ysseldyk et al., 2019). Relatedly, a study conducted by Dorenkamp and Weiß (2018) revealed that postdoctoral scholars' decision to leave academia relates to low job satisfaction and high rates of stress, and more prominently so for women than men.

Conceptual Framework

This study utilized the ideal worker conceptual framework as a lens through which to view the messages STEM postdoctoral scholar women receive about an academic career and family. The ideal worker paradigm extends from the white-collar male worker in the 20th century, which encouraged all employees to be productive and engaged workers who prioritize work above all else (Kossek et al., 2021; Miller & Riley, 2021). These ideal worker norms are tightly related to success in academic tenure-track positions, which are rigidly sequential and time-sensitive (Ahmad, 2017). These norms are more prevalent in STEM fields than in other academic departments, which leads to intense competition between the goals and demands of career and family (Thébaud & Taylor, 2021). Moreover, women are given heavier service and teaching loads than their male counterparts, further marginalizing their research productivity (Miller & Riley, 2021). This prioritization of work above all else exists in a tense duality with motherhood, which requires flexibility, attention, energy, and time. Naturally, motherhood does not conform to the ideal worker norms. It leads to conflict for many academic mothers as they are seen as less competent and committed to their work, which affects their professional legitimacy (Thébaud & Taylor, 2021). Since women tend to shoulder more domestic responsibilities than men, professional conflict occurs at higher rates for women than men (Kossek et al., 2021).

Method

Research Design. An instrumental case study design (Stake, 1995) was employed to explore the messages STEM postdoctoral scholar women receive about an academic career and pursuing a family. Instrumental case studies allow the researcher to uncover a specific problem or concern from the participants' perceptions that others may interpret as unimportant (Stake, 1995). Interviews grounded in the ideal worker conceptual framework (Kossek et al., 2021) provided insight into the messaging 22 STEM postdoctoral scholar women received about this topic. The research question that guided this study was: What are the messages STEM postdoctoral scholar women receive about balancing an academic career and a family?

Participants. This research study analyzed the interviews of 22 STEM postdoctoral scholar women. Participants were recruited from the National Postdoctoral Association (NPA) via an email alert. Participation was incentivized with a \$25 e-gift card. The sample comprised a racially/ethnically diverse group of women in STEM ranging in age from 28 to 38. Eight of the participants identified as single, one as divorced, three as living with a partner, and ten as married or in a common-law partnership; seven reported having at least one dependent. A summary of participant demographics is listed in Table 1.

Table 1. *Postdoctoral Scholar Demographics*

Pseudonym	Field of Study	Race/Ethnicity	Age	Marital Status	Dependents
Analia	Microbiology/Immunology	White	38	Single	No
Angela	Biomedical Engineering	Columbian	32	Single	No
Charity	Developmental Psychology	Black/White	34	Single	No
Dahlia	Biomedical Engineering	Asian	38	Married	Yes
Eya	Chemistry	Black	31	Single	No
Jade	Transportation	Asian	35	Living with a Partner	No
Jayla	Psychology/Neuroscience	White	37	Married	Yes
Kaia	Environmental Science	Black	33	Single	No
Katrina	Social Psychology	Latina	28	Single	No
Kelsey	Biopsychology/Neuroscience	Puerto Rican	30	Single	No
Kinsley	Immunology	Black	31	Divorced	No
Luna	Biology	White	37	Married	Yes
Lyla	Biomedical Engineering	White	32	Married	No
Meadow	Electrical/Biomedical Engineering	White	30	Married	No
Melanie	Immunology	Dominican/Polish	32	Living with a Partner	Yes
Morgan	Neuroscience	White	33	Living with a Partner	No
Natalie	Engineering Education	White	31	Married	No
Sadie	Neuroscience	White	33	Married	No
Scarlett	Biomedical Engineering	Black	31	Single	No
Sophia	Microbiology	Latina	29	Married	Yes
Suzanne	Developmental Biology	Latina	30	Married	Yes
Sylvie	Pediatric Radiology	Brazilian/White	38	Married	Yes

Note. Married may also indicate a common-law partnership.

Data Collection. Following Institutional Review Board approval, all participants were provided with a consent form detailing the purpose of the study, interview procedures, and safeguards in place to protect their privacy and confidentiality. A semi-structured interview protocol was designed to focus on participants' academic and personal experiences that led them to a postdoctoral position, aspects of their appointment that made the professoriate appear appealing

and unappealing, and the process they underwent in identifying their career goals. Sample questions included:

1. Who in your life encouraged you to pursue a Ph.D., and why were they influential?
2. What academic experiences led you to seek a postdoctoral opportunity?
3. Talk to me about your postdoctoral work. What are some of your favorite and least favorite experiences so far?
4. What experiences make you feel as though you belong in a STEM career?
5. What are the most important factors in determining your career path moving forward?

The protocol allowed for rich data collection through the pre-developed questions, but the interviews were unstructured and included embedded opportunities to seek clarification and meaning (Patton, 2015). All participants were given pseudonyms, and only de-identified participant interview transcripts were stored on a secured server accessible only to the research team.

Reflexivity and Positionality. Throughout the study, the research team engaged in both individual and collective reflexivity (Patton, 2015) by reflecting upon, bracketing out, and dialoguing about experiences, values, and beliefs pertaining to the messages women receive about balancing career and family in and out of academia. In qualitative research, reflexivity is a crucial component of inquiry. It positions researchers to consider their bias and its potential impact on meaning-making and interpretations during the data analysis process. Lincoln and Guba (1985) contended that researchers must disclose their positionality so that readers know what unique perspectives they bring to the study. The research team comprised social science academic women trained in qualitative research methods within educational settings. They hold professorship, administrative, and graduate student roles at a single higher education institution. All three are in long-term relationships, and one is married. Only one of the three has children, they were planned and timed purposefully to avoid interrupting her academic career; another chose not to have children; and the last is weighing the decision to have children. Each has received disparaging messages about being an academic mother (for example, questions about whether mothers are “serious scholars”), and one was told not to have children if she wanted to advance into academic administration. And while an academic career has provided flexibility and autonomy to chart their career trajectories, the lack of policies supporting mothers has created undue stress and decreased job satisfaction.

Data Analysis. Silverman’s (1993) and Stake’s (1995) data analysis strategies were employed to examine the messages STEM postdoctoral scholar women receive about considering an academic career and pursuing a family. Throughout the data analysis process, it was important for the researchers to be mindful of focusing on the participants’ experiences and perspectives rather than their own point of view, which was acknowledged through reflexivity. Silverman’s thematic content analysis technique follows an inductive approach to search for themes and patterns related to the research question. Using this method, the researchers coded the transcripts individually in a comprehensive manner and then collectively identified cross-references between the data and the evolving themes while memoing; this method allowed for flexibility when approaching research patterns inductively (Silverman, 1993). Process and evaluative codes were created, collapsed, and amalgamed into themes to summarize the messages STEM postdoctoral scholar women receive about balancing career and family (Patton, 2015). Process codes included observable and conceptual actions taken by the participants, such as planning for

a family and sharing career and family balance struggles with trusted advisors, supervisors, and colleagues. Evaluative codes included judgments about their ability to balance career and family, such as positive modeling and feelings that the “clock is ticking” on motherhood. Incorporating an inductive analysis process was critical in this inquiry because the interview protocol did not query specifically on family planning or messages about balancing career and family. Yet, those topics permeated the women’s interview transcripts across disciplinary background, race/ethnicity, age, marital status, and dependent status.

Stake’s (1995) four-step deductive data analysis process of direct interpretation, categorical aggregation, pattern recognition, and naturalistic generalizations was utilized to refine the themes that emerged during the inductive data analysis process. The ideal worker conceptual framework (Kossek et al., 2021) was used to develop a deductive coding protocol directing attention to how the prized employee is seen as one who devotes their life to work over personal responsibilities and interests such as family. The coding protocol was first used by researchers to independently make direct interpretations of the interview data by determining whether messages about the ideal worker were shared and how the participants internalized those messages. In the second step, categorical aggregation was accomplished by collectively reviewing the nuanced codes identified in step one and categorizing the codes into preliminary themes.

Using Stake’s (1995) third step of pattern recognition, the researchers developed more precise codes by refining the grouping of associated data, developing fuse codes, and reconceptualizing the preliminary themes. This allowed the team to identify the typical career and family messaging received by STEM postdoctoral scholar women and resulted in two themes: (1) STEM postdoctoral women receive messages that suggest they must sacrifice family pursuits for an academic career, and (2) positive modeling and support for balancing career and family are vital for retaining STEM postdoctoral women in the professoriate pathway. In the last step, the themes were evaluated to assess their naturalistic generalization by ensuring that the final themes represented the totality of the data and could be applied broadly (Stake, 1995).

Trustworthiness. Multiple verification strategies were employed to ensure the findings were trustworthy by attending to credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). Researchers utilized cross-case synthesis to address credibility, assessing whether themes were similar or different among the participants’ perspectives (Patton, 2015). Thick, rich descriptions with participant quotes ensured transferability (Lincoln & Guba, 1985). The researchers’ reflexivity and bracketing bolstered the findings’ dependability by providing transparency about their own backgrounds and experiences. Confirmability of the findings and conclusions was made possible by validating the themes both early and late in the data analysis process (Patton, 2015). Dependability and confirmability were achieved by involving multiple researchers in the data analysis process and by providing several feedback loops on the identified themes.

Limitations. As in all research inquiries, this study had several limitations. First, attention to career and family considerations emerged naturally during the interviews with the women participants and were not probed from the start, which can inhibit depth of understanding. Relatedly, the research team did not conduct member checks because of the difficulty of scheduling and conducting interviews due to participants’ demanding schedules. Member

checking might have provided more complex and nuanced depictions of the participants' experiences related to messaging about balancing an academic career and family. While the study attended to exposing researcher bias through reflexivity and positionality, its potential to influence the findings and interpretations cannot be guaranteed, notably since each researcher received negative messaging on this topic.

Findings

This instrumental case study explored the messages STEM postdoctoral scholar women received about pursuing an academic career and a family. Throughout the interviews, the women described weighing these decisions whether they were married, with a partner, or single. Each expressed a deep desire to have a family and a successful career in the professoriate. As a result of inductive and deductive data analysis, two themes arose: (1) STEM postdoctoral women receive messages that suggest they must sacrifice family pursuits for an academic career, and (2) positive modeling and support for balancing career and family are vital for retaining STEM postdoctoral women in the professoriate pathway. These themes align with the ideal worker conceptual framework (Kossek et al., 2021). Messages about the need to prioritize an academic career over children received by women diminish their eagerness to have a family since few experience positive modeling and support for women's successful balancing of career and family.

Must Sacrifice Family Pursuits for an Academic Career. All participants expressed a desire to have a family. Some even reported that they chose to pursue a postdoctoral appointment instead of moving into a tenure-track faculty position because they wanted to start a family. Jayla stated, "I knew that having a postdoc would be a good time to have a baby. So I felt comfortable taking the postdoc years to kind of grow my family and get more [research] experience." Morgan shared that she felt she was sacrificing her time to have a family by continuing down the academic career path: "these are my baby-making years too, and it's like, 'Am I going to see kids if I have them?'" Mothers shared a sense of guilt for struggling to balance their work responsibilities and wishing to spend more time with their children. Suzanne said:

My daughter is 14 months, so I think after she was born, it took a lot to get back into the lab. I think that was one of the most challenging times. Trying to know how to balance everything, you know the guilt of not being with her.

Sylvie, who also had a baby during her postdoctoral appointment, struggled to resume the heavy workload of her position. She commented: "I spent a couple of months not being able to do anything in a good way. I couldn't concentrate on my work, and it wasn't good work. I was a little bit lost trying to manage everything." Concepts of sacrifice and guilt were palpable in the interviews. These feelings turned into stress and frustration as the women considered how higher education exacerbates these realities for academic mothers.

Postdoctoral scholars planning to be mothers expressed concern about the lack of family-friendly policies in higher education. Melanie shared, "I would like to have kids, and I know that not every university or company has policies supporting mothers or families. So that will be important." Relatedly, Lyla shared that her university's health care options do not meet her family planning needs. She said, "My health insurance doesn't cover fertility treatments for me because I'm gay. So that is one of my biggest struggles right now in fighting with, not only my

employer but the insurance company too.” Lyla also discussed the importance of working in a state that allows same-sex, second-parent adoption, which limits her job search since only 10 states have these protections in place. For participants either in or expected to be in dual academic career families like Analia, Charity, Sadie, Meadow, and Jade, the reality of navigating the hiring process seemed daunting when combined with wanting a family. Analia shared that she would like to be at a university close to her extended family, but that may not align with her partner’s academic career interests, making her worry that she may have to sacrifice her career for family.

Among those universities with supportive family policies, nearly all expressed concern that the intense workload in academia is in opposition to having a family. Dhalia and Sophia noted having no time for anything except their lab responsibilities—especially not a family. Kelsey explained:

I just work, work, work, and I have no time for a life ... everyone works too many hours in higher education, the lab never shuts down ... it seems that it can consume your life, and not in a good way. I’m not sure what that would look like if I ever had children or a spouse.

Eya also shared, “I also would like to have a family of my own, but I think that the thing is that I work too much.” Additionally, some participants shared receiving messages suggesting that it was more acceptable for a man to have a family than a woman in academia. Luna shared:

I met with some women PIs that were five years ahead of me, and I went to ask, so I really want to be a PI because it’s all about freedom. And they told me it’s about freedom if you’re a man ... for example, if you made the decision to have a kid, then all your colleagues might just say, apparently your career is not your first objective, so I’m not sure I will be able to proceed and write you a letter [of recommendation] for you. So I was like, holy cow.

Meadow echoed this feeling: “so my husband and I are going to start a family ... I feel like I’m going to be more judged for taking time off or not doing things he’ll be doing [in his postdoctoral position].” Messaging about pursuing an academic career and family often suggested that women were expected to make the sacrifices.

Most of the STEM postdoctoral scholars were adamant that balancing career and family would drive their next career step. Kinsley said:

I don’t want to be one of those people where all you do is work, and then you don’t get to enjoy the family life ... I want [my career] to be a blend of my passion for bench science as well as being able to have a family life. Like to be able to, if I have kids, to be able to see them and not be past their bedtime when their mom’s coming home.

Katrina also reported that her happiness, including a family, would weigh heavily on her career decisions. She shared:

I want to publish papers, and I want to be successful in academia, but I also want to have a full life. I want to have children, and I want to have a husband ... I’m more than what I publish, and I’m more than just my job.

Interest in having a family drove some participants to consider government or industry employment opportunities as being more conducive to balancing work and family. Eya stated, “In academia, I will be sacrificing my personal life, because at the end of the day, the work that I’m doing, it is personal ... as compared to working for a company ... I would consider a

position in industry.” Morgan reported noticing that industry is ahead of higher education when it comes to family-friendly work environments:

If you plan on having kids, for example, they meet with you. They also meet with your partner if they also work at the company. And they’ll assess every chemical you come in contact with as part of your job, and if it is in any way teratogenic, they will change what you do ... they have these plans in place, and in academia, you have no idea.

If higher education is genuinely interested in diversifying the professoriate by recruiting and retaining women in STEM, the work environment must change.

Positive Modeling and Support for Balancing Career and Family Are Vital. Less than half of the participants reported receiving positive messaging through modeling and support for balancing career and family from their Ph.D. or postdoctoral advisors. Those who did pointed to them as critical to continuing down the STEM professoriate pathway. Katrina noted that her postdoctoral advisor was very supportive of her and shared his “key to success”:

Work like 8:00-5:00pm, 9:00-5:00pm, and then after 5:00pm, don’t answer any emails, spend time with your family. And on the weekends, I don’t work at all. Be focused at work and then enjoy life. He says it’s not all about academia, and he’s very well published, and I think that’s the model that I want to follow.

She explained that she ultimately chose her postdoctoral institution not only because her advisor demonstrated a healthy work-life balance but also because other faculty were good role models for balance. Scarlett likewise intimated that she chose her postdoctoral position because of the positive modeling she witnessed: “I saw people having a family not worrying about their career, things a woman worries about like I have to wait until this age to have a family. I see things very differently now. People are very open-minded.” Additionally, Kaia shared:

My graduate advisor was a good mentor in terms of what good science looks like, but not in terms of what a happy life looks like. So that was something that always made me think, ‘Oh, academia may not be for me’ ... I’m significantly happier and less stressed and less guilty than when I was a graduate student, and I think that a lot of that comes from the type of advisor I had before and the type of advisor I have now.

Favorable comparisons between graduate student life and postdoctoral work also arose in the interviews of Charity and Natalie and helped them to see a clear pathway to the professoriate with children.

Meadow shared that it has been essential for her to be around ambitious women faculty as they provide support for pursuing career and family balance: “They understand that I’m pushing myself, but they also want me to be happy in general ... I don’t really think you can have super great work-life balance if the people you’re working with don’t have respect for work-life balance.” Lyla, who has been trying to have a baby, felt like her postdoctoral advisor would support her desire to have a baby: “I’m really grateful that my job is very flexible, and my boss is understanding. I feel like I could have a child at this point in my life.” A few of the women had a baby during their postdoctoral position, and while they were ecstatic about motherhood, they also worried about how others would view their commitment to the work, especially their advisors. Luckily, all had positive experiences in this regard. Jayla shared, “personally, having a baby could have been a tricky thing, but my advisor was really enthusiastic right out the gate, which was awesome.” Suzanne also said her advisor:

Has a family, she has two boys ... she had young kids throughout this process, and she has been really instrumental in helping me navigate those early months back in the lab. And she has always been very clear in letting me know that I could take whatever time I needed before coming back to make sure I was okay. So definitely, I would say she has been a really good model because she went through it, so it's a little easier for her to understand that balance.

These clear messages of support aided in the postdoctoral women's commitment to entering the tenure-track job market as they saw it was possible to have a family in academia.

Discussion

This instrumental case study (Stake, 1995) analyzed 22 demographically diverse STEM postdoctoral scholar interviews. The study used the ideal worker theoretical framework to understand the messages STEM postdoctoral scholar women received about balancing an academic career with a family. While there is a growing body of research on the experiences of STEM women in academia, we believe this to be the first study explicitly examining the tension between career and family among STEM postdoctoral scholar women. Two themes emerged through inductive and deductive analysis: (1) STEM postdoctoral women receive messages that suggest they must sacrifice family pursuits for an academic career, and (2) positive modeling and support for balancing career and family are vital for retaining STEM postdoctoral women in the professoriate pathway.

Participants noted that their desire to have a family influenced their career decisions. Many felt they received messages suggesting that a career in academia was incompatible with having a family. Although all women in the study expressed an interest in having a family, not all were confident in their ability to be taken seriously as an academic mother, which led them to consider the need to sacrifice their family desires or pursue a career outside of academia, as others have found (Ahmed, 2017; Bird & Rhoton, 2021; Cech & Blair-Lory, 2019; Gregor et al., 2021; Lee et al., 2017; Miller & Riley, 2021; Thébaud & Taylor, 2021). While a few of the participants entered a postdoctoral position to allow themselves time to start a family before pursuing a tenure-track faculty role, most shared anxiety about having a child during their postdoctoral appointment or into a tenure-track faculty position. Several postdoctoral scholars reported reviewing their institutions' family policies to look for an institutional commitment to work-life balance and openly wondered whether their careers would stall if they had children. These findings are consistent with existing literature on this topic (Casad et al., 2020; Dorenkamp & Weiß, 2018; Hill et al., 2014; Kahn & Ginther, 2017; Kossek et al., 2021; Martinez et al., 2007; van der Weijden et al., 2016; Williams & Ceci, 2012; Ysseldyk et al., 2019).

The findings also add to the literature highlighting the importance of positive role models and support systems for women in STEM (Allen-Ramdial & Campbell, 2014; Rybarczyk et al., 2016; Yadav et al., 2020). The postdoctoral scholars who received positive messages about balancing an academic career with a family reported that it was critical to their decision to continue into the professoriate. Specifically, advisors who demonstrated a healthy work-life balance while being highly productive professionally were inspirational. Historically, women have felt the need to avoid having children or hide them when pursuing an academic career (Hill et al., 2014; Thébaud & Taylor, 2021).

Traditionally, tenure-track faculty positions have been strictly bound by ideal worker norms of productivity and the prioritization of work above all else (Ahmad, 2017; Kossek et al., 2021; Miller & Riley, 2021). While participants felt the constraints of these expectations, some, through positive modeling, saw ways to be successful without conforming to these norms (Thébaud & Taylor, 2021). Postdoctoral scholars who lacked positive role models felt constricted by institutional standards and career expectations which messaged that academic mothers could not be serious scholars. Thus, the baby penalty was well in effect (Ysseldyk et al., 2019). Higher education institutions must develop a more inclusive paradigm that supports realistic role expectations if they want to dismantle the concept of the ideal worker (Kossek et al., 2021; Miller & Riley, 2021). Institutional policies and practices supported by the National Science Foundation ADVANCE program promote a call to action to increase family-friendly policies to recruit and retain more women in STEM academia (Hill et al., 2014). While these policies and practices are espoused in support of women, all would benefit from a shift in the ideal worker expectation as it does not align with today's demands of the professoriate.

Implications for Practice. Colleges and universities must reflect critically on the overt and covert messages STEM postdoctoral scholar women receive about the need to sacrifice their family pursuits for an academic career. In order to create systematic change, family-friendly institutional policies must be enacted to support women's success in the STEM professoriate. Many participants shared both feelings and experiences, suggesting that higher education institutions lack caring cultures and protections to support postdoctoral scholars and faculty who desire children. Especially concerning is the fact these sentiments continue despite Title IX and the Family Medical Leave Act, which aim to dismantle gender discrimination. Additionally, establishing institutional-based training on how to model healthy work-life balance is needed throughout academia. Promoting individuals who do this well could pay dividends in recruiting and retaining women in STEM academia.

Future Research. While this study focused specifically on women-identifying STEM postdoctoral scholars, future research must focus on the experiences of gender-nonconforming and nonbinary individuals and the messaging they receive about balancing an academic career and a family. Likewise, attention needs to be directed to family-friendly policies inclusive of gay and transgender family planning needs. Additionally, further inquiry is needed to understand what policies and practices are most beneficial in recruiting and retaining women for STEM tenure-track faculty positions when they have or wish to have a family to ensure that women thrive in their postdoctoral positions and the professoriate. Finally, the concept of the "new ideal worker" (Maestro las Heras et al., 2020) needs more attention in the literature, particularly in the context of academia.

Conclusion

This instrumental case study (Stake, 1995) aimed to provide insight into the messages STEM postdoctoral scholar women receive about balancing an academic career and a family. This work aligns with and expands prior research in this area (Ahmed, 2017; Bird & Rhoton, 2021; Cech & Blair-Lory, 2019; Gregor et al., 2021; Lee et al., 2017; Miller & Riley, 2021; Thébaud & Taylor, 2021; Ysseldyk et al., 2019). The postdoctoral women in the study reported receiving frequent messaging suggesting that they must choose between pursuing the professoriate and having a

family while highlighting the importance of receiving positive modeling and support for balancing career and family. Positive modeling and support from Ph.D. or postdoctoral advisors were described as mitigating the negative messaging and essential to participants' career path considerations. Institutions need to consider how messaging about sacrifice limits the diversity of their tenure-track faculty candidate pool and further marginalizes women while recognizing the power of positive role models. It is time for higher education institutions to adopt inclusive, family-friendly policies and practices that support women pursuing the professoriate.

Funding Acknowledgment

This research is sponsored by the National Science Foundation (NSF) Alliance for Graduate Education and the Professoriate (AGEP; award #1821008). Any opinions, findings, conclusions, and recommendations belong solely to the authors and do not necessarily reflect the views of the NSF.

References

- Ahmad, S. (2017). Family or future in the academy? *American Education Research Journal*, 87(1), 204–239. <https://doi.org/10.3102/0034654316631626>
- Allen-Ramdial, S.-A. A., & Campbell, A. G. (2014). Reimagining the pipeline: Advancing STEM diversity, persistence, and success. *BioScience*, 64(7), 612–618. <https://doi.org/10.1093/biosci/biu076>
- Bird, S. R., & Rhoton, L. A. (2021). Seeing isn't always believing: Gender, academic STEM, and women scientists' perceptions of career opportunities. *Gender and Society*, 35(3), 422–448. <https://doi.org/10.1177/08912432211008814>
- Casad, B. J., Franks, J. E., Garasky, C. E., Kittleman, M. M., Roesler, A. C., Hall, D. Y., & Petzel, Z. W. (2020). Gender inequality in academia: Problems and solutions for women faculty in STEM. *Journal of Neuroscience Research*, 99(13), 13–23. <https://doi.org/10.1002/jnr.24631>
- Cech, E. A., & Blair-Lory, M. (2019). The changing career trajectory of new parents in STEM. *PNAS*, 116(10), 4182–4187.
- Dorenkamp, I., & Weiß, E. (2018). What makes them leave? A path model of postdocs' intentions to leave academia. *Higher Education*, 75, 747–767. <https://doi.org/10.1007/s10734-017-0164-7>
- Ecklund, E. H., & Lincoln, A. E. (2011). Scientists want more children. *PLoS One*, 6(8), 1–4. <https://doi.org/10.1371/journal.pone.0022590>
- Gregor, M. A., Weigold, I. K., Martin-Wagar, C. A., & Campbell-Halfaker, D. (2021). Tenure expectations and career aspirations among female assistant professors in STEM. *Journal of Career Development*, 1–16. <https://doi.org/10.1177/08948453211005032>
- Hill, P. W., Holmes, M. A., & McQuillan, J. (2014). The new STEM faculty profile: Balancing family and dual careers. *Papers in the Earth and Atmospheric Sciences*, 19, 3–20. <https://doi.org/10.1108.S1529-212620140000019001>
- Hoffman, J. L., Modjaz, M., West, A. A., & Graham, J. R. (2009, October 21–23). *Transitional states: Addressing the gender imbalance among postdoctoral researchers at UC Berkeley* [Conference session]. Women in Astronomy and Space Science: Meeting the Challenges

- of an Increasingly Diverse Workforce Conference, University of Maryland University College, Adelphi, MD, United States.
- Kahn, S., & Ginther, D. (2017). *Women and STEM*. National Bureau of Economic Research Working Papers. https://www.nber.org/system/files/working_papers/w23525/w23525.pdf
- Kossek, E. E., Perrigino, M., & Rock, A. G. (2021). From ideal workers to ideal work for all: A 50-year review integrating careers and work-family research with a future research agenda. *Journal of Vocational Behavior*, *126*, 1–18. <https://doi.org/10.1016/j.jvb.2020.103504>
- Lee, J., Williams, J. C., & Li, S. (2017). *Parents in the pipeline: Retaining postdoctoral researchers with families*. The Pregnant Scholar. <https://thepregnantscholar.org/wp-content/uploads/Parents-in-the-Pipeline-Postdoc-Report.pdf>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage.
- Maestro las Heras, M., Chinchilla Albiol, & Grau Grau, M. (2020). *The new ideal worker: Organizations between work-life balance, gender, and leadership*. Springer.
- Martinez, E. D., Botos, J., Dohoney, K. M., Geiman, T. M., Kolla, S. S., Olivera, A., Qiu, Y., Rayasam, G. V., Stavreva, D. A., & Cohen-Fix, O. (2007). Falling off the academic bandwagon. *European Molecular Biology Organization*, *8*(11), 977–981. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2247379/pdf/7401110.pdf>
- Miller, K. E., & Riley, J. (2021). Changed landscape, unchanged norms: Work-family conflict and the persistence of the academic mother ideal. *Innovative Higher Education*. <https://doi.org/10.1007/s10755-021-09586-2>
- National Science Foundation. (2020). *2020 National Science Board science and engineering indicators: The state of U.S. science and engineering*. U.S. National Science Board, National Center for Science and Engineering Statistics. <https://nces.nsf.gov/pubs/nsb20201>
- National Science Foundation National Center for Science and Engineering Statistics. (2019). *Women, minorities, and persons with disabilities in science and engineering: 2019*. (Special report NSF 19-304). <https://nces.nsf.gov/pubs/nsf19304/data>
- NPA ADVANCE. (2011). *Postdoctoral scholars, gender, and the academic career pipeline: A fact sheet*. <https://cdn.ymaws.com/www.nationalpostdoc.org/resource/resmgr/Docs/postdoc-gender-fact-sheet-20.pdf>
- Patton, M. Q. (2015). *Qualitative research and evaluation methods* (4th ed.). Sage.
- Rybarczyk, B. J., Lerea, L., Whittington, D., & Dykstra, L. (2016). Analysis of postdoctoral training outcomes that broaden participation in science careers. *CBE Life Science Education*, *15*(3), 1–11. <https://doi.org/10.1187/cbe.16-01-0032>
- Silverman, D. (1993). *Interpreting qualitative data*. Sage.
- Stake, R. E. (1995). *The art of case study research*. Sage.
- Thébaud, S., & Taylor, C. J. (2021). Culture and the production of gendered career aspirations in science and engineering. *Gender and Society*, *25*(3), 395–421. <https://doi.org/10.1177/08912432211006037>
- van der Weijden, I., Teelken, C., de Boer, M., & Drost, M. (2016). Career satisfaction of postdoctoral researchers in relation to their expectations for the future. *Higher Education*, *72*, 25–40. <https://doi.org/10.1007/s10734-015-9936-0>
- Williams, W. M., & Ceci, S. J. (2012). When scientists choose motherhood: A single factor goes a long way in explaining the dearth of women in math-intensive fields. How can we address it? *American Science*, *100*(2), 138–145. <https://doi.com/10.1511/2012.95.138>

- Yadav, A., Seals, C. D., Sullivan, C. M. S., Lachney, M., Clark, Q., Dixon, K. G., & Smith, M. J. T. (2020). The forgotten scholar: Underrepresented minority postdoc experiences in STEM fields. *Educational Studies, 56*(2), 160–185.
<https://doi.org/10.1080/00131946.2019.1702552>
- Ysseldyk, R., Greenaway, K. H., Hassinger, E., Zutrauen, S., Lintz, J., Bhatia, M. P., Frye, M., Starckenburg, E., & Tai, V. (2019). A leak in the academic pipeline: Identity and health among postdoctoral women. *Frontiers in Psychology, 10*, 2–17.
<https://doi.org/10.3389/fpsyg.2019.01297>