THESIS

VIEWS, GOALS, EXPECTATIONS, AND EXPERIENCES OF FAMILY AND WORK AMONG WOMEN AND MEN IN SCIENCE: A LONGITUDINAL PERSPECTIVE

Submitted by

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ABSTRACT

VIEWS, GOALS, EXPECTATIONS, AND EXPERIENCES OF FAMILY AND WORK AMONG WOMEN AND MEN IN SCIENCE:

A LONGITUDINAL PERSPECTIVE

In the United States women are underrepresented in many science fields, particularly in leadership positions. It has been theorized that work-family interface issues, including those related to having a spouse and children, are a critical challenge for women in science. Having a spouse and children, however, is not an experience unique to women in science, therefore theoretically at least, work-family interface issues are issues for men in science as well. Research on the work-family interface has primarily focused on women so it is less clear how men in science deal with work-family interface. Other limitations of the research on work-family interface are that it has been mostly cross-sectional and mostly focused on the undergraduate or the professional stages, with less information being available about the graduate and early post-doctoral years. This study examined female and male scientists' views, goals, expectations, and experiences of work, marriage and parenthood at two points in their educational and work trajectory, the first being the graduate-program stage, and the next being a few years later. Interviews with 8 scientists (4 women, 4 men) who were in a committed heterosexual relationship at time 1, and married by time 2 were conducted. In addition to the interviews, the participants completed a questionnaire about their educational, career and family background. The time 1 findings in terms of work, marriage and parenting were consistent with those of previous studies. Female scientists expressed gratitude to their partner, while male scientists

appeared to expect the support they received from their partner. Female scientists planned to make, and made accommodations for their partner's careers. Male scientists did not, and treated their careers as a priority. Female scientists viewed raising their children as their responsibility. Male scientists discussed investing in their careers as the means to fulfill their responsibility toward their children. The male scientists described family time mostly as a reprieve from work, not as another kind of work. By time 2, a polarizing shift in work, marriage, and parenting priorities and behavior was observed among both female and male scientists. For female scientists the shift coincided with the transition to being a mother. Female scientists talked about their science career as secondary to their partner's career. They also took on the majority or all childcare tasks. In contrast, male scientists had increased investment in their own career. Limitations of this study include that participants self-selected in the study and also that only one person from the couple was interviewed. The strengths include that this study focused on one field, that it was longitudinal, and that it included female and male scientists. This study's findings, together with those of related studies, suggest that two of the reasons that women are underrepresented in science leadership is that they are socialized to, and therefore often make career sacrifices to accommodate their family—including, in heterosexual couples, giving priority to their male partners' employment and taking responsibility for most if not all childcare. By contrast, men are socialized to, and therefore often invest in paid work as a way to fulfill both work and family responsibilities--which for male scientists in heterosexual couples often means having a career minimally or completely not encumbered by family responsibilities.

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Chapter 1: Introduction

In the United States (U.S.) women are underrepresented in science, particularly in science leadership positions, including in academia (Charlesworth & Benaji, 2019; Diekman, Weisgram, & Belanger, 2015). In 2017, women represented 37% of science faculty at institutes of higher education in the U.S., despite the fact that between 2006 and 2016 women earned about 46% of doctorate degrees in science fields (NSF, 2019). In the U.S., science jobs are among some of the highest paid. They are projected to grow much more than other fields (Diekman et al., 2015). Science, Technology, Engineering and Math (STEM) fields including computer science, environmental, physical, life, and social sciences typically earn higher than the median of all occupations, with computer science earning the most (U.S. Bureau of Labor Statistics, 2020). Between 2019 and 2029, certain STEM fields are projected to increase in employment opportunities anywhere from 6% to 15%, which is considered faster than the average increase of 4%.

These statistics are concerning considering that the U.S. gender pay gap has slowed its decrease over the last decade (Foster et al., 2020). As of March 2020, in the U.S., women on average earn 82 cents for every dollar that men earn (National Partnership for Women and Families, 2020). However, it appears that those numbers are not projected to shift, even with the projected job growth in STEM occupations. Also, because of the shortage of women in STEM occupations, women remain an untapped resource. A growth of women in science would contribute to economic development and national security (UN Women, 2018).

Work-family interface-issues have been theorized as a reason for women's underrepresentation in science leadership. This perspective is based on evidence that women

across science career stages, including graduate, and post-graduate stages, perceive challenges related to work-family interface. This is particularly true in relation to having a spouse and children (Carter, Blumenstein, & Cook, 2013; Ecklund & Lincoln, 2011; Goulden, Mason, & Frasch, 2011; Martinez et al., 2007; McCutcheon & Morrison, 2018). Having a spouse and children is not, however, an experience unique to women in science. In fact, female scientists are less likely than male scientists to be married and to be parents (Mason & Goulden, 2004).

It is a well-known fact that marriage benefits men and men's careers (Fry & Cohn, 2010). However, it is less clear how marriage specifically works for male scientists as compared to female scientists because most research on the work-family interface for scientists has focused on female scientists. Other limitations of the research on the science work-family interface includes that research has focused on the undergraduate or the professional stages, with less information being available about the graduate studies and early post-doctoral years. Additionally, research has focused on multiple fields at the same time and has been largely cross-sectional. This study, therefore, took a longitudinal perspective on the work-family interface for female and male scientists, and in a single science field. Its purpose was to explore the views, goals, expectations, and experiences of work and family among women and men at two points in time, the first being the graduate program stage, and the next being a few years later. Given the limited research on this issue, particularly from a longitudinal perspective, a qualitative approach was used.

Variability in Women's Representation and Experiences in Different Science Fields

Women's representation in science varies by discipline. In the U.S., women have the lowest representation in the physical sciences, computer science, and engineering and the highest in the social, behavioral, educational, and biological sciences. In 2016, women earned 31% of

doctoral degrees in the physical sciences and 49% in the social sciences. The most extreme discrepancy is seen between computer science where women earned 20% of doctoral degrees and psychology where women earned almost 73% of doctoral degrees (NSF, 2019). Similarly, in 2017 women held 22% of tenured faculty positions in the physical sciences, 38% in the social sciences, but only 48% in psychology (NSF, 2019). These data show that U.S. women still hold a smaller percentage of U.S. tenured faculty positions even in fields where they earn a higher percentage of doctoral degrees.

Women's representation among STEM doctorate holders by field also varies across countries (Scientific American, 2014). Women may be underrepresented among doctorate holders in a STEM field in one country, but not in that field in another country. For example, in 2010, women earned 62% of physical and biological sciences doctoral degrees in Portugal, 59% in Croatia, and 45% in the U.S. (Scientific American, 2014). The variability of women's representation in science and in academia by field, within and across countries, and over time, challenges the theory that women are underrepresented in science, in the U.S, due to intrinsic disinterest or innate deficiencies. The variability suggests that cultural and institutional factors, including gender ideologies and practices, likely play a role.

Atmospheric Sciences

This study focuses on a single field, Atmospheric Sciences (ATS). ATS is an interesting case in terms of women's representation. U.S. women earned 25% of ATS doctorates in 2002. The proportion of ATS doctorates awarded to women declined to 20% in 2008, then reached a peak of 42% in 2013, and declined again to 25% in 2016 (Charlevoix, 2010; NSF, 2019). The percentage of female faculty in ATS has not caught up with the percentage of women that earn doctorates. A survey study of 34 U.S. ATS programs found that in 2009, women represented

only 17% of tenure track and tenured faculty at those universities (MacPhee & Canetto, 2015). An academic career in ATS requires field work and sustained grant funding. Therefore, family decisions such as the decision to have children, might have a greater impact on a career trajectory in ATS than in other science fields that do not require fieldwork, such as Psychology (Canetto et al., 2017). However, research on how graduate students in ATS perceive and experience work-family interface issues including career and family expectations and goals has been limited (Canetto et al., 2012; Canetto et al., 2017).

The Graduate and Post-graduate Stages

The graduate school and the early post-graduate years were chosen as the focus of this current study, because they are critical stages in a science career. It is typically during graduate school that students evaluate their career paths and make decisions regarding direction of training, work, and family. Survey studies across science fields indicate that women's disinclination to enter into an academic career tend to solidify during the graduate school and post-doctoral years (Ecklund & Lincoln, 2011; Goulden, Mason, & Frasch, 2011; Martinez et al., 2007). An emerging theme is that women in science in the U.S. withdraw from academic science work due to marriage and parenthood related issues that arise during their graduate and post-graduate years (Barthelemy, McCormick, & Henderson, 2015; Canetto et al., 2012; De Welde & Laursen, 2011; Ecklund & Lincoln, 2011; Goulden et al., 2011). It is, however, unclear how and why graduate students family and career goals evolve over time during this important transitional period. A qualitative and longitudinal design is, therefore, necessary to investigate these issues in depth from the perspective of both women and men, across time. Women's and men's views, goals, expectations, and experiences related to marriage and parenting were chosen as the focus

of this study in order to explore dynamics that may be contributing to women's withdrawal from science academia.

Views, goals, expectations, and experiences of work and marriage of women and men in science graduate and early post-graduate programs

Research on the interface of marriage and work of science graduate students and early-career postdocs is limited. Two qualitative and one quantitative study were identified. An interview study with 30 female doctoral students in various fields including engineering, psychology, and sociology found that these female graduate students felt guilty and selfish about anticipated or current sacrifices that their male partners made or might make to support their careers (Abetz, 2016). Qualitative data from therapy notes from 1,436 counseling appointments with doctoral students in various fields (92 female and 36 male) revealed that female doctoral students reported relationship problems including conflicts with their male partner as related to their commitment to education. Some female students prioritized their male partners' emotional wellbeing and academic success over their own, leading to delayed degree completion. In this study the findings about the male students were not reported nor discussed (Carter et al., 2013).

The quantitative study was a web-based survey of 1,300 post-docs in the U.S. National Institutes of Health (NIH) (43% women, 57% men) which found that the female post-docs were more likely than the male post-docs to have a partner that worked full-time. Female post-docs were also more likely than male post docs to make career sacrifices for their partner's career. In the same survey, a lower percentage of female post-docs expected that their partner would accommodate their career than the male post-docs (Martinez et al., 2007).

Research on the work-family interface in ATS consists of two studies. The first of these studies involved interviews with 10 ATS graduate students (6 female, 4 male). It found that

while both women and men acknowledged the value of a committed relationship, only women talked about challenges posed by the relationship. Men either did not mention challenges or denied having any relationship challenges. For example, more married women than married men stated that they would make changes in their career to accommodate their spouse's jobs. None of the male students mentioned their female partners' career wishes as something to consider in their career planning (Canetto et al., 2012). The second study was based on interviews with female graduate students in ATS (n = 25). This study found that the female students felt that in order for them to have a career in academia they would have to give up their family goals. They also expressed the view that the male partner's career has priority, and doubt that their male partners would help with childcare or make sacrifices for their careers (Canetto et al., 2017).

Together, these studies suggest that female scientists at the graduate and post-graduate stages feel more obligation and responsibility toward their male partner's career than male scientists do toward their female partner's career. The female scientists are, therefore, more likely than male scientists to make sacrifices and accommodations for their male partners.

Views, goals, expectations, and experiences of work and being a parent by women and men in science graduate and early post-doctoral programs

Research on the interface of parenting and work among graduate students and early-career postdocs that includes both women and men is also limited. Seven qualitative and 2 quantitative studies were identified that explored that topic, but only 5 of them included both women and men in the sample (3 qualitative, 2 quantitative). Qualitative studies of women and men in science graduate and post-graduate programs indicate that female scientists perceive that academia and family are incompatible, whereas male scientists do not. A semi-structured interview of graduate students in biology and chemistry (n = 32;16 women, 16 men) found that

the female students believed that the culture of science did not allow them to have both a family and a career in science (Ferreira, 2003). Similarly, in response to open ended questions about their experiences in their science program, female post-docs (n =191), indicated that they believed that a career in academia would conflict with parenthood. The male post-docs (n = 103) did not discuss work and family tensions and were more likely than female post-docs to find an academic career appealing (Crabb & Ekberg, 2014).

Studies that included only women revealed a similar narrative among the female scientists. In an interview study female doctoral candidates (n = 30), from both science and non-science fields, these women reported being told by their families, that having children and having a career are mutually exclusive (Abetz, 2016). Similarly, an open-ended question survey study of women in psychology academia (n = 65; 33 graduate students, 32 faculty) found that women described either sacrificing their academic career so that they could have children, or putting of having children until getting further in their career. Furthermore, these women indicated that having family responsibilities was detrimental to their careers (McCutcheon & Morrison, 2018).

Another theme that emerged from research with graduate students in science was that the women believed that they could not have a family and academic career unless another person could assist with caregiving responsibilities (Barthelemy et al., 2015; De Welde & Laursen, 2011). An interview study with 19 female and nine male graduate students in STEM (including life sciences, geosciences, chemistry, physics, mathematics, and engineering) (including three women in the geosciences) found that the female scientists did not think they could get tenure and have children without childcare support (De Welde & Laursen, 2011). Similarly, a study of five female doctoral students who were asked to reflect on their career path in astronomy

suggested that women perceive science academia to be incompatible with having a family unless childcare is available (Barthelemy et al., 2015).

Studies found that male scientists and faculty are more likely to have children than female scientists and faculty (73% compared to 51%) (Goulden et al., 2011). Despite this, male scientists were much less likely to express concern about how their career might impact their time with family (Ecklund & Lincoln, 2011; Goulden et al., 2011, Martinez et al., 2007; Singer, Cassin, & Dobson, 2005). For example, a survey of scientists (684 graduate students, 504 postdoctoral scholars, and 1,315 faculty) in the top 20 doctoral programs in astronomy, physics, and biology at research universities found that four times as many female as male graduate students (and nearly twice as many female as male post-doctoral scholars) expressed concern that an academic-science career would keep them from having a family (Ecklund & Lincoln, 2011). Similarly, a survey study of female and male graduate students in psychology programs found that females more so than males expected that having children would disrupt their careers (Singer et al., 2005).

As a possible response to their concerns about not being able to have both a family and a career, female graduate students were more likely to make career choices that would accommodate children (e.g., more flexible hours) (Singer et al., 2005). This dynamic appears to be a reflection of gendered ideologies and institutions.

Collectively these studies indicate that graduate and early post-graduate women in science programs view and experience having a tenure track academic career as incompatible with having a family (Barthelemy et al., 2015; Crabb & Ekberg, 2014; De Welde & Laursen, 2011; Ferreira, 2003).

Evolution of women's and men's views, goals, expectations, and experiences of work, marriage and parenting over the course of their science graduate and early post-graduate studies

A longitudinal study was found that examined female and male scientists' views, goals, expectations, and experiences of work-family interface issues during the graduate school years, and then a few years later. This longitudinal survey, which included 346 women and 368 men in the top 15 math and science departments, examined work preferences, life values, and personal views during first or second year in graduate school and then ten years later. The findings suggest differences in occupational achievement based on decisions (e.g. relationships, community involvement, parenthood) made during graduate school. This included decisions such as whether and when to get married and have kids (Ferriman, Lubinski, & Benbow, 2009). A noteworthy and relevant finding from this study was that women tended to give more weight to their roles outside of work, including family, while men tended to focus more intently on their work. Interestingly, larger gender differences in work preferences, life values, and personal views were observed among parents, than non-parents. Men with and without children tended to respond similarly, but women responded very differently depending on whether they had children or not (Ferriman, et al., 2009). This suggests that parenthood has a more drastic impact on women and their career goals and expectations than it does for men.

Summary

The empirical literature on marriage, family, and work views, goals, expectations, and experiences of women and men during the science graduate and post-graduate years indicates that marriage and parenthood impact women more so than men. This literature suggests that female scientists find it difficult to have both a family and a career in academia while male

scientists do not. However, there is limited information available on how women's and men's views, goals, expectations, and experiences develop as they go through the transitions of marriage and parenthood, especially during the graduate and post-graduate years.

Only two studies specifically explored marriage, family and work views, goals, expectations, and experiences of women and men during the science graduate and post-graduate years within ATS. These ATS studies found that female scientists are much more likely than male scientists to experience challenges related to their relationship and work, and that they are also more likely than male scientists to make sacrifices in their career to accommodate their male partners (Canetto et al., 2012; Canetto et al., 2017). There were, however, no studies of work-family interface for women and men during the science graduate and post-graduate years that used qualitative and longitudinal measures. A one-time assessment provides valuable data but not on how these issues develop over time (Ecklund & Lincoln, 2011; Martinez et al., 2007). A longitudinal study design is therefore important to understand the evolution of women's and men's views, goals, expectations, and experiences throughout their studies in ATS.

The Current Study

The current study explored the views, goals, expectations, and experiences of work, marriage, and parenting of women and men in ATS during the graduate program stage, and a few years later. Given past research findings suggesting that the work-family interface is a source of tension for women in science, but without clarity on exactly how, this study used interviews to gather information on views, goals, expectations, and experiences of work, marriage and parenting.

This study aimed to answer three research questions.

1. What are the views, goals, expectations, and experiences of work and marriage of women and men in a science graduate program?
2. What are the views, goals, expectations, and experiences of work and being a parent of women and men in a science graduate program?
3. Do women's and men's views, goals, expectations, and experiences of work, marriage and parenting evolve over the course of their science doctoral studies and early post-doctoral years, and if so, in what direction?

Chapter 2: Method

Participants

Data for this study were drawn from a large U.S. study of women and men in STEM programs at two research universities. The original study explored the aspirations, expectations, challenges, and resources of scientists at various stages of their education and career. Between the years of 2007 and 2015, at time 1, the study included 120 females and 76 males: 15 undergraduate students, 160 graduate students, 4 post docs, 3 research scientists, and 9 faculty. These individuals were from multiples fields, including Atmospheric Science (n = 88), Chemistry (n = 5), Geoscience (n = 3), Health Science (n = 1), Engineering (n = 80), Math (n = 5), and Psychology (n = 10). Out of the total time 1 participants, 48 (28 females, 20 males) participated in time 2 data collection. Forty-seven of the 48 were in ATS, and 1 was in Psychology.

Inclusion criteria for the current study were that at time 1, the participants were enrolled in an ATS graduate program at one of the universities, and also in a committed heterosexual relationship. At time 2 the participants had to be married, and have at least one child or be expecting a child. Four women and four men met these inclusion criteria.

In order to protect participant privacy, their partners' employment has been changed to a similar field or career type.

Time 1. At time 1, two women were in the master's program and two in the doctoral program. In the pre-interview survey one of two women in the master's program indicated that she probably would not pursue a PhD, and the other did not respond to the question. One man was in the master's program and the other three in the doctoral program. In the pre-interview

survey the man in the master's program indicated that he definitely would pursue a PhD after getting a master's. Participants ranged in age between age 24 and 32 (female age range, 24-28; male age range, 25-32). All but one identified as European American. For privacy, participants were not asked about sexual orientation. However, in the course of the interview, all reported being in a heterosexual relationship. At time 1, all were in a committed relationship, with most being married (3 women, 4 men). The length of the relationship for the female scientists ranged from 2.25 to 9 years. Age of partners ranged from 23 to 29, with one participant not reporting her partner's age. All female scientists reported that their male partner was employed full-time. Male partners' employment included video game design, computer programmer, mechanical engineer, and cashier at Kohls. One female scientist indicated that her male partner was employed as an engineer and a part-time veterinary student. The length of relationships for male scientists ranged from 3 to 13 years. Age of the female partners ranged from 26 to 34. Two reported that their female partner was employed part-time as a zoologist and a community health worker. The other two reported that their female partner worked full-time as a biomedical equipment technician and in forestry. None of the female scientists had children, but all indicated that they wanted children. Three of the male scientists had children who lived with them full-time (7 days a week). The ages for the male scientists' children ranged from 4 months to 3 years with two of the children being female and one being male. The male scientist whose partner was employed full-time stated that someone other than him provided childcare 30 hours a week (excluding time in school). The other two whose partners were employed part-time estimated 20 and 60 hours.

Time 2. At time 2, about 1 to 6 years later, two of the women were doctoral students. The other two reported working as atmospheric scientists. Two of the men were in a doctoral program, one was a post-doc, and one was an assistant professor. Participants ranged in age from

age 27 to 35 years (female age range, 28-33; male age range 27-25). All participants were married. In the female sample, the length of relationships ranged from 6 to 12 years (one did not report length of relationship). Three of the women reported that their husband was employed full-time as a computer programmer, as a manager, and in videogame design. One reported that her husband was a full-time student in veterinary school, and not employed. In the male sample the length of relationships ranged from 7.5 to 15 years. Two of the men reported that their wives were employed full-time, one as a biomedical equipment technician, and one in forestry. The other two reported that their wives were unemployed. Six of the eight participants (2 female, 4 male) reported having children. Two female scientists reported expecting a child. All participants' children lived with them full-time. The ages of female scientists' children were 10 and 20 months. The female scientists reported that someone other than them did childcare 35 and 45-50 hours per week. Two of the male scientists had two children, and two had one--the age of their children ranged from 11 months to 5 years. One male scientist did not answer the question about how many hours someone other than them provides childcare during the week. The male scientist who had 2 children and whose wife was employed full time reported that someone other than him provided childcare 36 hours a week. Another male scientist who had one child and a wife who was unemployed reported that someone other than him provided childcare 60 to 70 hours. Finally, the male scientist who had 2 children whose wife was not employed, reported that someone other than him did childcare 40 hours a week. All but one female scientist ranked that having/raising children was what they planned to focus on most in the next 5 to 10 years. The other female scientist ranked it as her second most important focus. Two of the participants did not put any ranking for finding steady employment/job security. One scientists ranked it as 7th, and another ranked it as 4th. Out of the male participants, one did not rank what he planned to

focus on most. Out of the other three, one ranked having/raising kids as 2nd, one ranked it as 4th, and one participant that had 2 children wrote in N/A. One male scientist ranked financially supporting his children and/or wife as 1st, one ranked it as 2nd, and one ranked it as 4th.

ATS Department Demographics. During the six years of the study, the ATS department from which the sample was drawn had between 84 to 94 graduate students. The percentage of female graduate students in the department ranged from 35% to 38% over those 6 years. During the study period 58% of the female students completed a master's degree, and 34% a doctoral degree. 60% of the male students completed a master's degree, and 40% a doctoral degree. Finally, during the 6 years of the study, there were 12 to 15 tenure-stream faculty in the department. The percentage of tenure-stream female faculty varied from a low of 8% (one woman out of 12 faculty) to a high of 27% (four women out of 15 faculty).

Procedure

ATS scientists were recruited via e-mail invitation, in-class announcements, and peer referrals. Participants were told that the study's goal was to explore their views, goals, expectations, and experiences as ATS graduate students. Upon consenting to participate via email, the participants were sent the questionnaire that asked about their demographic and educational background, and career and family plans. Demographic, educational and career information about their partner as well as demographic information about children was also collected. Participants were asked to bring the completed survey to the interview meeting. The interview explored supports and challenges the participants experienced in their relationship/marriage. The interview also focused on their family plans and what impact family had on their graduate studies and career. Follow-up questions were based on participants' responses and encouraged elaboration on main ideas.

At least a year following the first interview, participants were sent an email invitation to participate in a follow-up interview. Upon consenting via email, participants were again sent the questionnaire with a request to complete it based on their current situation. There was an average of 2.5 years (range of 1-6 years) between the two interviews. The interviews, which lasted 60–90 minutes, were conducted by trained, female and male psychology researchers in a private room on campus. Participants were given a small compensation for their time. These procedures were approved by the institutional review board of the university where the study took place.

Demographic information about the faculty in the department in which the participants completed their ATS degree during the years when the interviews were conducted (time 1: Fall 2007 to Spring 2009; and time 2: Spring 2011 to Spring 2015) was obtained via an online university run Institutional Research, Planning and Effectiveness website.

Data analysis

Interview coding. The interviews were coded by two European-descent, U.S. born and raised women, one a graduate student in counseling psychology (hence called senior coder) and the other an advanced undergraduate psychology student (hence called junior coder), under the supervision of a bi-national and multicultural senior female psychology professor with expertise in women, men and gender, and a substantial record of research and publications on women, men and gender in STEM. The latter was also involved in data integration and interpretation.

Reflexiveness. Interviewers and coders responded in writing to questions about their personal experience with, and attitudes about, women and men in science. This was to record personal frameworks that might impact their interview style and findings and/or their coding (Lincoln & Guba, 1985). Additionally, coders reflected on the process of coding via memo notes, which were recorded as footnotes in the transcripts, and discussed during coding meetings. These

reflexivity data are examined as context to the findings as well as considered as strengths and limitations of the study in the discussion section.

Interpretive Phenomenological Analysis. The interviews were audio recorded, transcribed verbatim, and edited for accuracy. The two coders extracted text about the participants' relationship/marriage. Once this process was complete, the coders analyzed the data based on the interpretative phenomenological approach (IPA), as articulated by Quinn and Clare (2008) and by Smith, Flower, and Larkin (2009). The initial coding phase began with the coders reading all the transcripts (eight time 1, eight time 2). Next, the coders identified meaning units (highlighted segments of text relevant to the research questions) and labeled meaning units using margin notes (a comment written on the side of the transcript that stated why the highlighted portion of text was important using participants' language, wherever possible). In the third step, coders compiled margin notes into a list (each coder had a list of their individual margin notes). In the fourth step, organized margin notes into thematic areas, as called by Quinn and Clare (2008) or emergent themes as named by Smith, Flower, and Larkin (2009). The senior researcher was present at the coder meetings, reviewed the emergent themes, and participated in the discussions about emergent themes.

Following the initial coding phase, the senior coder identified connections across emergent themes and then organized the themes into clusters based on similarity. The transcripts were then recoded using the theme clusters as recommended by Smith et al. (2009). The above procedure was repeated for each transcript. Finally, the senior coder identified common concepts across all transcripts and organized the themes into super-ordinate themes. While themes could appear in some transcripts, but not in others, super-ordinate themes appeared in all, therefore

linking the data (Smith et al., 2009). The synthesis phase of coding involved the senior coder and the senior researcher.

Data were analyzed first by time of data collection, first for time 1 and then for time 2. Coders alternated between reading female and male transcripts. Themes were described for each transcript separately and then nested under super-ordinate themes for each group (time 1 females, time 1 males, time 2 females, time 2 males). Female themes were also compared to male themes across both times, to understand the differences and similarities between the views, goals, expectations, and experiences of female and male scientists.

Trustworthiness. The interviews were coded independently by researchers trained in qualitative analysis. Prior to the beginning of coding, the coders read and met to discuss relevant readings and coded practice transcripts. Once all coders were able to accurately identify and discuss the framework of the study, and identify relevant sections of text, coding of the actual transcripts began. During the coding stage, coders met one to two times a week for two months to review and revise codes and determine final themes via discussion and consensus.

Measures

Questionnaire. Demographic (e.g., relationship status, children), educational history and stage of educational/career development, and family organization (e.g., childcare) information was gathered via a written questionnaire given at time 1 and time 2. The questionnaire data were used to supplement the data from the interviews.

Time 1 questionnaire. At time 1 the participants were asked to indicate whether they were in the master's or in the doctoral Program. Additionally, participants were asked how many years they had been in their current program. If they were enrolled in the master's program, they were asked if they thought they would continue into the doctoral program, with response options

ranging from “definitely yes” to “definitely no.” Participants were also asked whether they were “single and unattached,” “single and attached,” or “married/commitment ceremony.” Additionally, they were asked about the length of their relationship as well as demographic, educational, and employment status information about their partner. Finally, they were asked whether or not they had children. If they had children, it was requested that they provide information about each child’s age, sex and living arrangement (see Appendix A).

Time 2 questionnaire. At time 2, the participants were asked to respond to the same questions as in time 1 except for questions about past educational history. An option was added for combined master’s/PhD program to the question about current educational status, with a follow-up question asking them to indicate whether they were working on their master’s or doctorate or if they had graduated. If they were no longer students, the participants were asked to describe their current employment status (see Appendix B).

Interviews. The participants were asked about their views, goals, expectations, and experiences. The interview included some broad questions as well as specific questions regarding relationship/marriage and parenting. The study drew on both sources, since relevant content came through often in broad questions as well as specific, even if broad questions were not directly focused on the topics explored in this study.

Educational and career views, goals, expectations, and experiences.

Time 1 interview. The participants were asked about their education and career goals and the challenges to achieving these goals. Master’s students were asked if they planned to pursue a doctorate following their degree, and what factors would contribute to that decision (see Appendix C).

Time 2 interview. Time two interviews explored the same topics as in the first interview, but with a focus on whether anything had changed or remained the same since the first interview. For example, the following questions were asked to gather information about education and career and if and how anything may have changed since time 1; "What are your main school experiences or issues? How has this changed or remained the same in the past year?" (see Appendix D).

Views, goals, expectations, and experiences of work and marriage. To explore views, goals, expectations and experiences of their relationship/marriage and work, the participants were asked to respond to questions about their views, goals, expectations, and experiences about their relationship/marriage and how their relationship/marriage impacted and was impacted by their studies and/or work.

Time 1 interview. At time 1, the participants were asked to "describe how their relationship/marriage enhanced and how it challenged their educational and career goals." The participants were also given an opportunity to discuss how their relationship/marriage impacted their educational and career plans (see Appendix C).

Time 2 interviews. Time 2 interviews explored the same family topics as the initial interview, but with a focus on whether, since the first interview, anything had changed or remained the same. The participants were asked how their partner had influenced their education and career choices and what impact their relationship/marriage had on their educational/career path and vice versa (see Appendix D).

Views, goals, expectations, and experiences of work and being a parent. The participants were asked about their views, goals, expectations, and experiences of work and being a parent with questions about their plans to have or experiences with having children. They

were also asked to reflect on and discuss the intersection of their family views, goals, expectations, and experiences with their views, goals, expectations, and experiences of education and work.

Time 1 interview. The participants were asked questions about how having children or plans to have children had affected their career choices. Additionally, the participants were given a chance to discuss challenges related to their career and having children, and how these challenges might impact their career in the future (see Appendix C).

Time 2 interview. Time 2 interviews focused on the same topics as time 1 interviews, with questions focusing on if and how anything had changed since the initial interview in terms of the participants' views, goals, expectations, and experiences of being a parent (see Appendix D).

Evolution of women's and men's views, goals, expectations, and experiences of work, marriage and parenting over the course of their graduate studies and early post doc years. To answer the questions of how the participants' views, goals, expectations, and experiences of work, marriage, and parenting evolved over time, information from time 1 interviews was compared to the information from the time 2 interviews. Information about participants' relationship status, number of children, and plans to have children, and career progress was also included in the analysis. This information was gathered from both the questionnaire (questions regarding career stage/plans, partner and children) and interviews (see Appendix A-D). The focus was on what participants said and how what they said changed or stayed the same between the two different interviews.

Chapter 3: Results

Themes are reported by time of interview and by topic (first marriage and then parenthood).

Women's views, goals, expectations and experiences of marriage and work at time 1

At time 1, female scientists viewed a science career and marriage as competing investments. They mentioned feeling immense gratitude to their male partners/husbands for their support, but said that they would need to make compromises in their professional work in order to give back to their male partners/husbands and maintain a healthy relationship/marriage.

Committed relationship requires a lot of give, especially on my part. Female scientists, at the graduate stage, stated that they aimed for both a strong science career and a strong relationship/marriage. They viewed and experienced their relationship/marriage and a science career as competing investments, because they felt that they had to make compromises or sacrifices in their career for the sake of their relationship/marriage. Some expected that there would be give and take in their relationship/marriage in terms of career. For example, a female scientist said that she and her male partner planned to take turns at pursuing their individual educational and career goals:

> …as far as challenges, we're kind of having to give and take, because we both have all these professional ambitions...so I'm finishing my degree and then he gets to start his. …we both want so much and we both want that for each other. I know it's his turn and I would love for him to have a turn, but I also want to be able to take care of myself and to take care of us. (24-year-old, female, single and attached, no children, in master's program)

Others said that they would hold back on their career goals in order to accommodate their male partner's/husband's career. For example, one stated:

> I'd certainly be willing to do something else in order to be in the same place as him. I think I would continuously search for an atmospheric science job if I had to have another job so that I could eventually get into it, but... certainly temporarily I'd be willing to do something else . . . [to] be living with him (27-year-old female, married, no children, in doctoral program)

The same scientist talked about downscaling her career investment, specifically her professional travel so her marriage would not "lose out:"

> I don't think I would want to travel that much. In that sense, I feel like I'm a little bit limited in how far I want to go, because the farther you go, the more renown you get, the less time you have to do stuff; and to me it's not worth it. I want to have a career, but I also don't want to become so wrapped up that my personal life doesn't lose out. (27-year-old, female, married, no children, in doctoral program)

She also expressed guilt when she put her career first:

> I was fortunate enough to go to Italy for a conference this year, which is really cool, but it would be expensive for him…to go along, and so he doesn't really get to travel with me right now and so, it's hard…I feel bad for leaving for two weeks or whatever, but at the same time I'm really excited about going, but I always feel a little twinge (27-year-old, female, married, no children, in doctoral program)

Even though they were ready to make sacrifices for their male partners/husbands, female scientists said that they did not want their male partner/husband to make sacrifices for them. For example, a female scientists stated that she was hesitant to pursue a doctorate, after completing

the master's, because her doing a doctorate would require her husband to stay in a job he did not like:

> I [may not be] able to stay in this field…I don't want him to be stuck at a job he hates just for me to finish my [doctoral] degree. (24-year-old, female, single and attached, no children, in master's program)

I am lucky that my husband is so supportive. Female scientists gave much recognition and praise to their male partners/husbands for their support. The support they said they received ranged from financial to emotional. For example, one stated:

> My husband's been extremely important to me, because he was willing to leave this job at a company that he basically helped start and move out to a place that he'd only been to once, that's a thousand miles from his family, and support me. We basically live on his salary, so, that's been huge and he's so supportive…(28-years-old, female, married, no children, in master's program)

Another said she considered herself "lucky" to have a supportive husband:

> I've been lucky that my husband has been nothing but supportive (28-year-old, female, married, no children, in doctoral program)

Women's views, goals, expectations and experiences, of marriage and work at time 2

At time 2, female scientists reiterated many of the same ideas they had raised at time 1, but with even more insistence on their duty to sacrifice their science career to accommodate their husband's wishes. They also emphasized their gratitude to their husband for his emotional and practical support of their career.

My husband's needs have priority over mine. Female scientists not only said that their husbands' educational and career goals were important to them and that they needed to be

contended with, but they also talked about their husband's educational and career goals as having priority when deciding what to do next as a family, for example, where to move. This is how a female scientist who had already completed her doctorate and took a temporary research scientist position discussed her experience and expectations about her career needing to be secondary to his:

> …my husband is in medical school and he is graduating next year. And then he has to do a residency program, so our plans and my work plans are up in the air at that point. It's possible that we'll move again when he does that and if that's the case, there's a chance that I will do a post doc somewhere. But it's less an educational opportunity and more [about being]. . .willing to do a post doc if I get paid to do research [to be near him] (31-year-old, female, married, one child, PhD, employed as research scientist)

Another female scientist explained her decision to stop at the master's level as linked to her husband's moving to a different state for his own studies. She said that she believed she should follow him, not the other way around.

> Leaving with a master's was a decision that was made partly professionally and partly personally. I got married the Summer after we spoke, and my husband was starting a master's program the following Fall and so he was moving to Georgia. And so that was the personal part of my decision to stop at a master's. (28-year-old, female, married, expecting first child, MS, employed as scientist)

The post-doc whose husband was in medical school discussed her expectations that her husband's work would come first. She talked about how once he completed his MD and started making more money, she would take on more of the childcare responsibilities and work less:

> It will definitely help in terms of I won't feel so much pressure to have all the income on my shoulders. So that will help, but on the other hand he might be busier than he is now. So that might be hard. That might mean I need to be around more [to take care of our child], and not take on as much work myself when that happens. (31-year-old, female, married, one child, PhD, employed as research scientist)

I am lucky that my husband is incredibly supportive. The female scientists consistently described their husbands as supportive. They said that their husbands provided emotional support, but did not give examples. For example, a female scientist said:

> Overall, I would say he's been a positive impact on my education and my career path. Both as just the support system and emotionally and all that kind of support. (30-year-old, female, married, expecting first child, in doctoral program)

The female scientists expressed the most gratitude when their husband took on responsibilities that they considered the domain of women, such as housework. One pregnant doctoral student stated:

> My husband is very helpful…he doesn't like the fact that I'm working a lot now, but he understands that it's better that I work a lot now instead of later this year. So, he's helpful with doing stuff around the house, and cooking dinner and that kind of thing, so I can focus a little more on work. (30-year-old, female, married, expecting first child, in doctoral program)

Another female scientist talked about her husband being "awesome" and "incredible" for giving priority to her career. She however thought that this was not because he wanted to sacrifice his career for hers, but because he did not have career ambitions of his own:

> My husband is hugely supportive. He has been awesome in his flexibility of his career. He's not the kind of person who's entirely ambitious and driven so he's willing to do whatever I need. And that's incredible. (33-year-old, female, married, one child, in doctoral program)

Men's views, goals, expectations and experiences, of marriage and work at time 1

Being in a relationship/married is not a challenge for my career, my relationship/marriage only requires occasional attention. Male scientists did not see being married as a challenge for their career, that is, as requiring give and take, compromise or sacrifice in terms of priorities and deciders. They mostly viewed their partner/wife as supportive to them and only requiring occasional attention. For example, two male students said:

> Transitioning from being single to being attached to being married maybe has reduced the time that I've had to work, but I don't feel like it's reduced the quality [of my work]. . . . maybe things just take a little longer, because I don't have as much time to work on them. (26-year-old, male, married, no children, in doctoral program)

> [No challenges to my career as a result of being married] other than time conflicts. . . There's not a whole lot of interaction. I mean, it's not like I go to my wife for research ideas and technical problems. She doesn't really get involved in that too much...I don't really see a whole lot of interaction [between marriage and work]. (25-year-old, male, married, one child, in master's program)

The master's level male scientist described as a marital challenge the fact that his wife did not like it when he traveled for work. He stated that he could not afford to bring her along as if the family money was his money only:

> My wife . . . gets angry whenever I get to go on these special trips. I had a meeting in Alaska a couple of years ago… I couldn't afford to bring her along. She didn't really like that. (25-year-old, male, married, one child, in master's program)

I want to get to a place where my wife doesn't have to work. Male scientists expected and wanted their career to be primary in their marriage. They thought of themselves as having responsibility and the right to make money for the family. In other words, they appeared to see themselves as having a right to work and to making their own money but did not seem to conceive of their wives as also having a right to work and make money. For example, one male scientist discussed wanting to get to a place where his wife might not be engaged in paid work.

> What I'd like to do eventually is [get to] a place where my wife is not forced to work, if she wants to work, she can. I don't want her to be like you have to stay home and nothing else. But if she said she'd like to at least part of the time…of course I feel bad that I can't do that now, because graduate students don't exactly make [money] for two or three people. That's . . . [a] personal expectation I haven't fulfilled yet. (29-year-old, male, married, one child, in doctoral program)

What matters in choosing location of school or work. Male scientists had a diversity of opinions in how much their wife's needs and desires would matter in their next location move. Some expected that their careers would be the deciding factor in where they would go. One stated:

> So far we think that her field is more general than mine and that my prospects for employment are going to dictate where we live more than hers, because it seems as though there are only a few places in the country with the job that I'm looking for. (26-year-old, male, married, no children, in doctoral program)

Others said that their wife's job or education prospects might play a role in where they ended up going. For example, male scientist, in response to whether his wife's career would impact his career choices, said:

> [my wife's career] could affect where we can move to, assuming we both want to work. Which, at this point, we probably will in a few years. So, we'll probably be more apt to move to a more metropolitan area, just because that's where her jobs tend to be located. (25-year-old, male, married, one child, in master's program)

Another said his wife chose the region where they were currently lived:

> I ended up coming here mainly because my wife decided that she wanted to live near the mountains instead of in Maine, where it might be too dreary. (32-year-old, male, married, one child, in doctoral program)

My wife is very supportive. Male scientists described the many ways in which their wife had been a major boost to their career. They gave examples of the emotional, intellectual, and financial support they received from their partner/wife. For example, one male scientist said:

> My wife's been very supportive. She has a master's degree also, and so [she] knows what graduate school is like. So, that's also helpful, to be in a relationship with someone who knows what you're going through. She's just been very supportive of me…it's not only intellectually challenging and beneficial but it also, financially helps down the road. It's an investment. It's an investment in your future and her future as well. (32-year-old, male, married, one child, in doctoral program)

Despite describing how much their wives did for them and the family, the male scientists did not always articulate how their wives had been critical to their career and their well-being. One male scientist, whose wife was the primary caregiver for their child, said:

> Yeah, it's kind of a background support thing, it's just constantly there. It's not like an everyday 'I support you. Go do your stuff.' sort of thing, but it's there. (25-year-old, male, married, one child, in master's program)

Men's views, goals, expectations and experiences, of marriage and work at time 2

At time 2, male scientists discussed similar issues to time 1, including the pressure and the entitlement for their career to be primary and to generate financial resources for the family. At this time, all male scientists were still married to the same partner as in time 1.

View marriage as a source of challenges in terms of time limitations and pressure to be primary earner. When discussing challenges, the male scientists brought up how their relationship placed some constraints on how much time they could devote to work. They talked about the pressure to make money to support the family. This is how one male scientist described balancing his time between work and family:

> …[I am] trying to keep [my] wife happy, [the] family happy, being there once in a while at least so that's probably the biggest issues…I can't think of a positive way, unfortunately, because it's probably more straining with all the stuff I have to do...not having the well-defined boundaries might be a problem…You try when you can to bail out or skip a day [of work]…When you really don't have to be there…the inner perfectionist in you is saying "well you should go fix this and that" and you say "well I should just-, it's good, it's not perfect but it's good" and then to just skip out and stay home that kind of thing would be important and the career choice right now is again the monetary strain doesn't help, that's always the big one. (31-year-old, male, married, two children, PhD, employed as Assistant Professor)

The expectation that they would be employed and make money came up in the interviews with the male scientists, even when his wife was gainfully employed.

> Both my wife and I work and we both want to continue working. So, we are trying to balance a lot of objectives, between finding jobs that we like that pay well enough to support us that are closer to our family. So that definitely adds a lot of stress as to the difficulty of it. (31-year-old, married male, two children, in post-doctoral program)

In general, male scientists expected and wanted to be the primary earner. Some made comments about their wives not working due to not finding a job that would pay enough for childcare—suggesting that childcare was their wives' responsibility, and that their wives' right to work was contingent on how their work was retributed relative to the cost of childcare. They never discussed their right to work as contingent on how much they were paid, relative to the cost of childcare. The sense from the interviews was that the men viewed paid work as their responsibility and right. For example, one male scientist stated in answer to whether his wife had a job:

> She has not been able to find anything here. That doesn't help, but then again we have another issue because she's got to make enough to cover two kids daycare…If she gets paid less than ten bucks an hour you lose money, which doesn't make any sense. (31-year-old, male, married, two children, PhD, employed as Assistant Professor)

My wife gives me complete support and makes career sacrifices for me. Married male scientists viewed their wife as supportive of their career choices and making sacrifices in their own work lives to accommodate them. They did not talk about giving back to their wives, in terms of career support. One male scientist stated:

> She's been very supportive the entire time. We've had our ups and downs like any relationship, but she's just been extremely supportive of this decision of me going back [to get his doctorate]. We both had pretty good jobs in Texas and [she] was willing to number one stop working so could I get my master's degree and then to move from Texas with good jobs to North Carolina, bit of an unknown, so it's risky. It's complete support and it's worked out well so, we've done well. (35-year-old, male, married, one child, in doctoral program)

Another male scientist talked about how his wife contributed to his career:

> I guess I have to say that it's been an extremely positive experience for me and her working together in that sense, but she's been extremely lax about everything I want to do. So, if I need to take a trip or go somewhere or do a little internship somewhere it's never really a big deal, but at the same time I think it is. Like, I can't do things like a summer internship. Like three months in another city. That's just not going to happen. So, there's a definite impact in that sense. But generally, it's really good, and because of the way her job works it kind of helps me do my work. If she were to have an actual day job—she works nights on the weekends at the hospital—so it works out so well that we don't have to pay for childcare that way. We can kind of switch off. (27-year-old, male, married one child, in doctoral program)

The same scientist also stated that his wife motivated and supported his work commitment:

> My wife [is] always saying, "Get a job, get a job." So that's plenty of motivation to get out there. (27-year-old, married, one child, in doctoral program)

Women's views, goals, expectations and experiences, of parenting and work at time 1

At time 1, female scientists discussed their expectations that they would be the primary caregiver for their children. Female scientists without children discussed their plans for children and how having children would impact their career because their children would be their responsibility.

My children will be my responsibility. Female scientists without children discussed family and work as competing demands. They expected that having children would lead them to make career sacrifices because they expected parenting to be their responsibility. They did not articulate other options. Additionally, they talked about the importance of their being consistently involved with, and physically present to their children. They seemed to believe that it was their duty to sacrifice their science career for family. They did not mention expecting their husbands to be equally available to raise their children. For example, this female scientist stated:

> I have family that's out here, relocated, and (if I have) children that I have to worry about...I'm going to put them before my career. It's just the way it is…(28-year-old, female, married, no children, in master's program)

Another female scientist said this about her views on parenthood:

> It's the woman who has the baby. There's the time involved while you're pregnant and maternity leave. I think that men are definitely capable of taking care of children, but there is just more of a maternal instinct there for women, and so I think it's harder to leave a child for any job. So, I think it's just more of a consideration that women have to take into account. (28-year-old, female, married, no children, in doctoral program)

One female scientist, in response to how having children would impact her career decisions, stated that for her it would be a "luxury" to be able to stay at home with her children:

> [Having kids] definitely will [affect my career decisions]. I think, I'd like to stay home to be honest. I'd like to have that luxury. I don't know if I will or we will, but, I have lots of ideas and I'd like to be really involved…(24-year-old, female, single and attached, no children, in master's program)

Female scientists expected their husbands mostly to "help" with caregiving; and if taking on the primary caregiver role, not on a permanent basis because a man would not be pleased with such an arrangement. For example, a female scientist stated:

> The idea for him of staying home with kids was not pleasing at all. It was certainly not something that he'd ever really thought about doing for permanent. I'm sure he thought about helping out, but he was always going to be a software programmer and dad…His family is actually very traditional; it's very similar to mine. So, it is going to be interesting to see how that works out. (28-year-old, female, married, no children, in master's program)

The female scientists also discussed how their parenting goals impacted their career plans. They stated that they did not want to pursue a career in academia, because they viewed and expected, based on their experiences, a tenure-stream career to be incompatible with having children. To illustrate this point, one female scientist said:

> I really find right now that to be a professor as a woman seems really hard, because you're trying to get tenure at the same time that you want to have kids, so that's been so discouraging… I don't think I will become a professor. I think I'll just do research… there's a lot of flexibility in government work and they put importance on the family and maternity leave. So, that's more the type of job I want to do, because to me, my family will be just as important as my job and so I don't want to have to sacrifice my time with

my family to get tenure or whatever. (27-year-old, female, married, no children, in doctoral program)

Women think about the when, how, and why of having children. Female scientists described their concerns about and plans for when they would have children, and how children would fit into their lives. For example, one female scientist discussed how she thought that her and her husband's careers might impact when they would have children:

> I started thinking that it would be a better idea for us to wait several years before we started thinking about having a family. Because, then he would be in his mid-forties and more thinking about maybe an early retirement and more open to the idea of being a main caregiver. And then it would be my turn for a career at that point and I could be the primary provider. (28-year-old, female, married, no children, in master's program)

The same female scientist discussed her hope that her parents would be able to move near them so her mother could help with childcare:

> I'm hoping that she [my mother] might be okay if they [my parents] come out here when we have kids, that she will be okay with being a secondary care provider while I'm at work. That would definitely be better for the kids – to have a big family and not have to go to daycare all the time. (28-year-old, female, married, no children, in master's program)

Female scientists discussed when they thought would be the best time to have children in terms of their careers. Some women appeared to believe that during graduate school was a better time than later on. This is how a female scientist reasoned about why she and her husband decided to have a baby while she was in graduate school:

> It's kind of scary (having children), but it's something we both want at some point… I think because it's not a job where I have to be there x number of hours a week- I mean, it's going to be hard, but I think it might be easier than doing it when I have a real job down the line...it's a little more flexible so we'll see. (28-year-old, female, married, no children, in doctoral program)

Women's views, goals, expectations and experiences, of parenting and work at time 2

By time 2, two female scientists had their first child, and two were expecting their first. The profoundness of this life change was reflected in the urgency and vividness with which they talked about many of the same ideas as they did during time 1.

Becoming a mother was a radical change. Female scientists who had had or were expecting their first child since time 1 interviews described experiencing a "radical change" in their career and personal goals. They discussed how having or expecting a child made it increasingly challenging to attend to their education and work, causing major delays in degree completion. This is how a female scientist described her experience of having a child while in graduate school:

> I don't think I realized what I was getting into. I could tell that it just felt like, I had all this time ahead of me, like I got years to finish this PhD, it will be fine. And then all of a sudden two years were gone, the baby, the 9 months of pregnancy…some women can just totally do it, like they don't even notice that they are having a baby inside and it's no big deal to them. And for me, I had really terrible pregnancy brain. I felt like I've been lobotomized by progesterone. I could not put together a sentence. I couldn't remember what I had done that morning, I couldn't figure out where my keys were. I mean it was just terrible short-term memory loss and I was not doing a lot of good work during that

> time period. And then, after the baby was born, I took about 3 or 4 months off. The next semester coming back was difficult. So, it was probably 18 months to nearly 2 years before I hit my stride again, with all of that happening. (33-year-old, female, married, one child, in doctoral program)

They reported a decrease in their work ambitions, and an increased desire to spend time with the family following the birth of their child. For example, a female scientist commented that her "number one greatest achievement as of last summer was that [her] baby had gained fifteen pounds," which illustrates the shifting focus from career and education accomplishments and goals, to family goals.

Along with the increased pull toward family, female scientists reported feeling guilty if they were not able to spend as much time with their children as they thought they should. This is how one female scientist described how having a child had impacted her career:

> Having a baby definitely changed my perspective on some things, but I think that I still want to work and have a career and do research. So that hasn't changed. But I guess perhaps some of my ambitions have waned a little bit…My family is more important to me now and I want to make sure that I have time with them, and I don't want to be spending long hours after work or on big projects that take up a lot of time. And if that means sacrificing some big promotion or big paper than that is okay with me now, which might not have been true a year or two ago. (31-year-old, female, married, one child, employed as research scientist)

Children determine career and future life planning. At time 2, the topic of children was at the center of the female scientists concerns. Female scientists expressed uncertainty about how their science work and family would fit together. They did not talk about how their

husbands would contribute to the child-raising responsibilities, implying that their husbands were exonerated from family caregiving.

When discussing plans on when to have children, female scientists stated having to decide based on where they were in their career trajectory, and considering financial factors versus having a more flexible schedule. For example, a female scientist who was expecting a child while in graduate school said that she believed she would have more time to be a parent as a student versus later in her career:

> If we have a child now I'm not making a lot of money, but my job is very flexible. I can work from home easily or come in strange hours or whatever, but if we wait until I have like a quote-end-quote real job then, we'd have more money so we'd be more financially stable, but I would be more tied to being at work at certain times. So, ultimately we decided for the flexibility over the financial security (30-year-old, female, married, expecting first child, in doctoral program)

Her husband's caregiving contributions were not included in her calculations of a best time to have a child.

Female scientists talked about pursuing jobs that would be less demanding and that would allow them to spend time with their children. This is what one female scientist said when discussing why she would prefer a research scientist position over a tenure track position.

> There is a lot of appeal to straight research position right now. When you're just doing research, you are not having the workload of teaching on top of your research, so, it does make your life simpler in that way. And I feel like simpler is better right now, and it's been my total mantra since the baby was born…Getting back into the work has been, you know, paring everything down to the bare essentials, what do I need to do right now?

> And it's been; I need to finish the PhD, I need to find a job, I need to keep my baby healthy and happy and spend as much time with him as I possibly can. (33-year-old, female, married, one child, in doctoral program)

Female scientists who were pregnant anticipated that having a baby would make it difficult for them to work and were planning accordingly. For example, this female scientist stated:

> …to get as much done now as I can, because I know when I have a child it will be harder probably to work as much as I feel like I need to…(30-year-old, female, married, expecting first child, in doctoral program)

Another voiced her concerns in this way:

> I am interested in what other people do, especially now we're looking at childcare and the possibility of someone working from home, quitting their job, and it's like, "well how do people do this?" I have no idea…(28-year-old, female, married, expecting first child, MS, employed as scientist)

A female scientist who had one child and was planning to have another said:

> I think if we have a second child that will be harder. With one it's reasonable, because she goes to daycare and I feel like I still have a handle on things, but when there's two, daycare costs are so expensive for two and then I know I'm going to be really torn between them both and going to work, and I think I still will, but I know that it's going to be a struggle when that happens. (31-year-old, female, married, one child, PhD, employed as research scientist)

This female scientist is speaking in the singular in terms of handling childcare. Her husband is not part of her child raising plan.

Another female scientist shared that she had not originally taken into consideration children when making career decisions. However, now that she was expecting a child, she was spending much more time considering how this might impact her choices. This is what she said when asked how having a child had impacted her career decisions:

> [My husband] is staying in this job and we're more intent on moving back to Arizona. We don't want to raise a kid in New Jersey. So in terms of that, we're not looking for jobs immediately, but in the near term, after the baby's born, we're going to be looking for something else. (28-year-old, female, married, expecting first child, MS, employed as scientist)

Men's views, goals, expectations and experiences, of parenting and work at time 1

At time 1, the male scientists, with and without children, discussed their expectation that they would be the primary earner, and not the primary caregiver to their children. They said that they did not expect that having children would impact their career unless their children had serious health problems. Men viewed having children as adding playtime to their day, not extra responsibilities or extra work.

My science career won't be impacted by having children, except perhaps if they have serious health problems. Male scientists reported that they did not think much or plan when to have children, and did not worry about how children would fit into their lives. They did not see their career being impacted by having children except under special circumstances, like their child having a serious illness. For example, a male scientist described his plans to have children in this way:

> It was kind of like, let it go and see what happens. I mean we're not going to like every month dive into this one particular day...but it's like, just kind of let it go and then it happened…(25-year-old, male, married, one child, in master's program)

Even when they recognized that their wife might be invested in her career, they still talked about how their career would come first. This is what one male scientist said about his views and experiences:

> Since both of us are pretty career driven, we both want to have great jobs. We both want to have kids. We've often talked about it and it's one of the biggest question marks about the future. How are we going to balance this? It's probably one of the most difficult things in life, if you're both in specialized fields, to both live in a place where you can have decent jobs and have kids. So far we think that her field is more general than mine and that my prospects for employment are going to dictate where we live more than hers, because it seems as though there are only a few places in the country with the job that I'm looking for…and kids factor into that…Of course we want to live near our families too, for the benefit of our kids. (26-year-old, male, married, no children, in doctoral program)

Male scientists who had children talked about expecting and/or experiencing work challenges when the child was first born, but did not expect being a father to require permanent adjustments to the work patterns or goals. A common sentiment among male scientists was that their work investment and goals might be impacted by their children only under special and presumably time limited circumstances, like their children having a serious illness. This is how one male scientist responded to being asked about how having children would impact his career:

> I've thought about it a little bit. I don't think they have to affect your education, but definitely has that ability. Like if there is any complications and then obviously it will

> take away from your professional side, if you're worried about the health of your kid or something. It's definitely going to negatively affect your work. (26-year-old, male, married, no children, in doctoral program)

This male scientist reported experiencing some work difficulties when his first child was born, prematurely.

> Ever since we've had the baby, I've had the most trouble trying to get back into my work. It was such a shock, because she came early that for the first month or so, if I did go in and sit at my desk, I would just sit there and just like, "I don't know what I'm doing…," or I'd be searching the internet for things about prematurity. I wouldn't really get anything done for the longest time. I'm still having a little trouble with it, but we're getting back into it…Originally, it was planned that I was supposed to be done with my Masters in October and she was born in July and it just threw everything off, so I'm still coasting on this one, but hopefully next semester. (25-year-old, male, married, one child, in master's program)

However, when asked about his expectations of future career challenges as related to being a parent he said:

> The actual act of having a kid was a barrier to my education for a few months. That was pretty much the only barrier either way I think. Other than that, it's been fine. No real problems. No conflicts between them other than that… I don't foresee any, but you never know. (25-year-old, male, married one child, in master's program)

Another male scientist whose child experienced health problems said that the decision had been for his wife to quit her job. Nothing changed for him education- and career-wise to accommodate for his daughter medical needs.

> We had a young daughter who had some medical issues. We decided that it would be beneficial for her [his wife] to stay home for a couple of years with her, until she goes to school. (32-year-old, male, married one child, in doctoral program)

I am not going to be my child's primary caregiver--I would go crazy if I had to. Male scientists reported feeling pressure to complete their graduate studies so that they could provide financially for their family. They saw their career success as their way to contribute to their children's and family's wellbeing, and did not seek to, nor want to be the children's everyday caregiver. This is how some male scientists discussed the pressure to succeed as a scientist and to be their family's financial provider:

> If everything goes well and your kids are healthy you might feel more pressure to succeed in what you do. You want to provide the best possible life for your children and, I mean it adds motivation in that sense, but it also adds pressure on your time as well. (26-year-old, married male, no kids, in doctoral program)

> It's something I keep trying to work on. How to balance family and work, church, all that good stuff. It's a tough one…You work here all day eight to four, eight to five, whatever. It's a little harder to do the original thing I would do that's eight to eight…But you get there and you say, "oh here comes five and I'm not done, if only I had another half hour." But then you get to that hour and, "if I only had another half hour." Eventually I think you have to get to this maybe piece of yourself to say, "I've got as much as I could get done today. I'll make progress tomorrow." Not somewhere I am, but it's somewhere I guess you need to. I need to be home and then you're at home and you say, "gosh I really need to be working…" (29-year-old, male, married, one child, in doctoral program)

The same male scientist said this in response to how having a child had impacted his career choices:

> It hasn't affected the choices, mostly the time thing again… I mean it is quickly obviously. You need to have money to support and things like that. It's a time balance. It's a further thing to put on the balance beam. Other than that, no not really… it doesn't affect the choice of where to go. (29-year-old, married male, one child, in doctoral program)

Furthermore, men linked investment in their career as their contribution to their children. For example, they discussed wanting to be able to afford living in areas with access to good schools so that their children could get a good education:

> Obviously we want to say avoid the upbringing that both of us had in high school…I really didn't have the science opportunities. Didn't have as many music opportunities or art or whatever… you want to have as many opportunities as possible. So, in that way, you want to find a place that has a really good school district as well. (29-year-old, male, married, one child, in doctoral program)

At the same time, the male scientists were very clear that they did not see themselves as available and open for the day-to-day care of their children. They expected either their wife or another family member to take on childcare work--work that they viewed as extremely stressful. This is how one male scientist worded his views on childcare:

> I would go crazy if I had to stay home all day. I love staying home with our son, but I couldn't do it every day. (29-year-old, male, married, one child, in doctoral program)

Being a father and having children is fun. Male scientists described having children as bringing fun to their lives. This is how one male scientist framed his expectations and experiences of being a father:

> It's been both good and challenging in ways. The good part is it makes you focus on something completely different and you realize what's important, you know. The challenging part is that you have to focus on them…It takes a lot of time to be a parent, if you're going to be a good parent, I think…It's not always the easiest life balance, I would say. But I think it has more benefits than negatives…it's just fun, once you do it. It's a lot more fun than what you imagined it to be (32-year-old, male, married, one child, in doctoral program)

Men's views, goals, expectations and experiences, of parenting and work at time 2

At time 2, male scientists expressed many of the same views, goals, expectations, and experiences they had conveyed at time 1. Their view was that they had a responsibility to provide financially for their family, a responsibility that was synergic with investing in themselves and their science career; and that childcare was their wife's responsibility no matter how stressful and demanding they recognized childcare to be.

Being a good father means providing financially for the family. As at time 1, male scientists talked about their goal of providing financial resources to their family. They framed investing in themselves and in their science education and career as their way of being a good father. This is how a male scientist justified his ambition for a high and permanent position in science:

> In terms of wanting to further my career and my family's well-being, I am looking for something permanent. But that being said, permanent positions in science fields require

> continuing education as part of your job duties. (31-year-old, male, married, two children, in post-doctoral program)

Another stated that his success as an academic would benefit his children: "The perks of this career path tend to be their future education…" (31-year-old, male, married, two children, PhD, employed as Assistant Professor). The statement is another example of how men constructed investment in their science career as a form of family caregiving. The same male scientist stated:

> I'd want to find a place that has something better because with the money we have now, we'd never be able to afford for them to go to school and there's a definite impact there…it impacts their future. (31-year-old, male, married, two children, PhD, employed as Assistant Professor)

When male scientists considered leaving a science career it was for the potential of earning more money. This is how one explained this possibility:

> I guess now having a wife and small children, you sort of look at your career a lot differently. When I was younger, especially when I got into the field, it was more about the personal motivation thing and wanting to help mankind…help society…And as you have children, and get married, that switches a lot. I still have that motivation… But due to the challenges that I mentioned earlier in terms of finding a permanent job, and how it's maybe more difficult than finding a soft engineering job or something, and it pays less…What matters is taking care of your family first, and that sort of supersedes any personal motivations that I have…Those relationships more than anything else has changed my ability to stay in the field…The reality is, if there are no jobs, I need to find another way for my family if that happens. If providing for the family means that I have

to change fields, I will have to find another way to save the world. (31-year-old, male, married, two children, in post-doctoral program)

Caregiving for my children is not my responsibility. At time 2, as at time 1, male scientists said that having children did not impact their science work, because they were not the ones to take care of their children or manage their children's care. They did not discuss childcare or concerns regarding who would take care of the children while they were at work. When their children had special needs, it was their wives who gave up on work to take care of their children. The men made it sound like that for the wives to have to leave their job to take care of their sick child was a positive event--though they did not mention ever considering doing the same. One male scientist stated:

> [My wife] had a very stressful job at that time. She was happy to take a couple years break, especially we have a daughter who was diagnosed with asthma and has some slight medical issues and the ability for her to stay at home with her was actually great. She really enjoyed that opportunity and is ready to get back to work now. (35-year-old, male, married, one child, in doctoral program)

The male scientists again mentioned experiencing some work challenges when their children were born. These challenges however were discussed as short-lived, and as not impacting their career. One male scientist with two small children described his experience in this way:

> We have two small children and it made a huge difference in terms of my ability to do my work, especially when they were first born. The general lack of sleep, it really affects how well you can do your job. So that's definitely been a challenge…(31-year-old, male, married, two children, in post-doctoral program)

Being with children is a mini vacation. Spending time with children was seen as a reprieve or a way to get a break from work. This is how one male scientist described his experience.

> …when you have someone who isn't going to understand a lick of what you're saying and you're not going to talk about work you can go back and gosh I don't know, I can't think of an example-, you run around in the back yard or dig in the sand box and you're not thinking about oh my gosh, I've got to do this prep and that prep and this and what am I going to do. Things kind of evaporated. There's no better mini vacation…(31-year-old, male, married, two children, PhD, employed as Assistant Professor)

This is how another male scientist described how having children is a source of fun, and a distraction from work:

> They always manage to make sure you don't get too lofty… for example, I defended on Monday, and Tuesday morning I was cleaning up pee off the floor, so I just think things like that keep you grounded. For me it's been a great experience, and it's been a great distraction to not think about work; to come home and focus on her, and she's more interested in playing Barbie or whatever else so, it's actually been a great experience to have during the time. It's just been a really fun age to experience at this time…(35-year-old, male, married, one child, in doctoral program)

This male scientist experienced having children as beneficial to his work because it made it easier for him to be productive:

> While some 22-year-olds go out to the bars on weekends I stay home and play with my kid and that makes it easier to go in Saturday morning and work, so it's really dependent

upon a person's personal life and what they're doing there. (35-year-old, male, married, one child, in doctoral program)

Male scientists discussed experiencing some strain between work and family mainly when what they thought busy work would pull them away from family time. For example, one male scientist stated:

> They schedule meetings from four in the afternoon until five and then you've got kids who go to bed at 6:30 PM, so you cut out an hour of time…when we came here the first week during the new orientation, they said you've got to carve out time for yourself. Well you're taking all my time away with these meetings where we don't accomplish anything. (31-year-old, male, married, two children, PhD, employed as Assistant Professor)

Chapter 4: Discussion

This longitudinal qualitative study explored female and male scientists' views, goals, expectations, and experiences of work and marriage, and work and being a parent at two points in time. The first point in time was when these scientists were in graduate school. The second was a few years later, during the later years of graduate school or just post degree completion.

Female and male scientists' views, goals, experiences, and expectations of work and marriage

The female scientists in this study seemed to view their role in their relationship/marriage as one of support to their male partners/husbands, with their work/science career as secondary to the work wishes and priorities of their male partners/husbands. This was reflected across times 1 and 2, in their statements that they expected to make, and experiences of having made compromises in their science educational and career goals to accommodate their male partner's/husband's needs and goals. The female scientists' perspective was that their male partner's/husband's needs and goals were more important than their own, and that they should strongly influence whether they completed their doctorate, where they lived, and what job they pursued, if any. Some female scientists were open to giving up their science career and also to not completing their doctorate in order to support their male partner/husband. These findings are consistent with those of other studies of graduate and early post-graduate female scientists. For example, interview and survey studies show that female graduate and post-graduate scientists are more likely to make sacrifices in their careers for their partners/husbands, while male scientists are more likely to expect sacrifices from their partners/wives and do not consider accommodating their partners'/wives' careers (Canetto et al., 2012; Canetto et al., 2017;

Martinez et al., 2007). This has been shown to have consequences for female scientists' careers. For instance, an analysis of anonymous counseling session notes with female doctoral students, showed that their prioritization of their partners'\husbands careers leads to actual delays in degree completion (Carter, Blumenstein, & Cook, 2013).

The female scientists in this study also profusely praised their partners/husbands for their emotional and financial support. For example, they described themselves as "lucky" to have a supportive husband and were particularly emphatic in their gratitude if the husband had moved for them or if he "helped" with tasks that they viewed as their responsibility (e.g. childcare, household chores). Some even expressed feeling guilty or selfish for the "help" they received or when their male partner/husband made sacrifices for them. This is a pattern that was also described in an interview study of married graduate level female scientists in different fields—suggesting that the feelings of guilt and selfishness may not be an uncommon experience for female scientists in heterosexual relationships (Abetz, 2016).

By contrast, across time 1 and 2, the male scientists did not say that being in a committed relationship/marriage required accommodating their female partner's/wife' s needs and goals. The male scientists expected their careers to drive most, if not all, family decisions, including where to live. They seemed to view work as their primary responsibility, and their relationship/marriage as an occasional diversion from work. The male scientists appeared to be aware that they tended to make more money, and used their economic advantage as a way to justify why they "needed" to prioritize their career. The support they received from their partners/wives was expected--not something to express gratitude for. Some male scientists even said that their female partners/wives had very little bearing on their career, despite having described various ways in which their partner/wife had made major personal and professional

sacrifices for them. They did not express feeling guilty for the generous career support they received--including moving with them, doing household chores, or being in charge of childcare. These findings are in-line with those of previous studies of graduate and post-graduate men in science (Canetto et al., 2012; Carter et al., 2013; Martinez et al., 2007). For example, in an interview study of both female and male graduate level scientists, it was found that the male scientists' biggest challenges and future goals all revolved around their desire to have a successful career and earn a lot of money. The male scientists did not mentioned their partners'/wives' support or express any concern about accommodating their partners'/wives' careers (Canetto et al., 2012). All evidence considered, then it is no wonder that male scientists do not report much tension between their work and marriage. Within our patriarchal system, career and marriage tasks align for men because to be a good husband a man simply needs to invest in his own occupational success and advancement. Within patriarchy, women are expected to put their wishes and goals after those of men, in the family and outside (Canetto et al., 2012; Wall, 2008).

Female and male scientists' views, goals, expectations, and experiences of work and parenting

The female scientists in this study talked a lot about having to choose between career and family. They also said that they would rather compromise their science career goals than their parenting goals. For the female scientists in this study being a good parent meant being available and present for their children. One even stated that she would like to have the "luxury" of staying at home with her children. In cases where they had to compromise their parenting responsibilities, female scientists expressed feeling guilty. Additionally, the female scientists expressed their belief that that they cannot have a family and a career in academia. The female

scientists in this study discussed caregiving options that they might pursue to make a career in science possible, including grandparents. They, for the most part, did not expect their husbands to take on an even share of the caregiving role. These gendered expectations about parenting (and with it, logically, the view that academia is not compatible with being a good mother) is a finding that has been described in several previous studies of graduate and post-graduate scientists (Barthelemy, McCormick, & Henderson, 2015; Crabb & Ekberg, 2014; De Welde & Laursen, 2011; Ferreira, 2003, Van Anders, 2004). For example, an interview study with women and men in STEM doctoral programs revealed that the female scientists had significant concerns about being able to meet their family goals and pursue a tenure track career in academia (De Welde & Laursen, 2011).

Another view and experience among the female scientists in this study was that having children led to a radical change in their career trajectory. The female scientists in this study described delays in degree completion and waning career ambitions as a result of having children. Some of the female scientists stated their desire to pursue a research career over academia due to those careers offering more flexibility, and therefore more opportunities for them to be present for their children. The female scientists' dedication to childcare responsibilities was reflected in their responses to the survey questions about their life priorities. Three of the four female scientists ranked having/raising children as most important, and one ranked it as second most important. This kind of evidence from this study and other studies of graduate and post-graduate female scientists' explains why for female scientists having children is viewed and becomes incompatible with a science careers (McCutcheon & Morrison, 2018; Mirick & Wladkowski, 2018; Van Anders, 2004). For example, an interview study of 28 women who were pregnant during their graduate school years in a health care field found that these

women felt that becoming a mother resulted in missing opportunities in graduate school or while searching for a job. Most of the women expressed a desire to find jobs in family-friendly places, meaning places valued and supported their employees to have family responsibilities (Mirick & Wladkowski, 2018).

When it came to parenthood and work, male scientists did not view raising their children as their responsibility. They seemed willing to occasionally share childcare duties with their wives, but downsizing their career to raise their children was never considered. This was reflected in their responses in the time 2 questionnaire. Unlike the female scientists, the males scientists did not rank having/raising children as their most important focus. They were more likely to rank highly employment related goals, such as financially supporting their family. In the interviews, the male scientists viewed time with their children as a fun break from work. They also expressed that they would get involved with care for their children only when the children had *serious* health problems. Therefore it is not surprising that in this study, male scientists actually had more children than female scientists. Two of the four male scientists had two children, and the other two had one. In contrast, two of the female scientists only had one child, and the other two were still expecting their first. This study's finding about male scientists are consistent with national trends that show that male scientists are more likely than female scientists to have children (Goulden et al., 2011; Mason & Goulden, 2004). Taken together, the findings of this study and of other studies about male scientists and fatherhood indicate that male scientists are less concerned about, and can afford to be less concerned about family having a negative impact on their career (Ecklund & Lincoln, 2011; Goulden et al., 2011, Martinez et al., 2007; Singer, Cassin, & Dobson, 2005).

Evolution of female and male scientist's views, goals, expectations, and experiences over time

At time 1 and time 2 female and male scientists discussed many of the same marriage and parenting issues. The differences between them grew over time.

For the female scientists, the challenges discussed at time 1 increased in intensity by time 2, especially because by that time, they had or were expecting children. Female scientists who were expecting children described planning for delays in their education and careers. Those who had children described major delays in their graduate schoolwork due to the childcare responsibilities. Having children also impacted female scientists' career goals. While at time 1, the female scientists talked about their science career ambitions and considered academia as an option, by time 2, academia was less of an option, if not completely ruled out. Overall, by time 2, female scientists' career ambitions decreased and their sense of obligation to fulfill family related responsibilities increased. For example, one female scientist who at time 1 talked about a desire to travel for her career, appeared to almost fully give up on this idea by time 2. These findings relate to those of previous research (Abele & Spurk, 2011; Cech & Blair-Loy, 2019). A longitudinal study of highly educated professionals from various STEM and some none STEM fields, showed that women reduced their work hours more so than men, especially women that had partners/husbands that worked full time (Abele & Spurk, 2011). Another longitudinal survey study of women and men in STEM revealed that 43% of women left full-time STEM employment as soon as they had children (Cech & Blair-Loy, 2019).

In stark contrast to how at both time 1 and time 2 female scientists discussed work and family, male scientists' response to having children was to increase their career investment. Male scientists reported only temporarily decreasing their career investment when their children had

serious health problems. The male scientists in this study described spending time with their children as fun or relaxing, and not as a responsibility.

Work, Marriage, and Parenting Among Women and Men in the United States

A review of the broader literature on work, marriage, and parenting reveals that the experiences of graduate and early post-graduate female and male scientists documented by this study are not specific to scientists at those stages, not to scientists. Female scientists experiencing tension between their work and family life is a social issue common in both science and non-science fields. One reason is that since women have increased their presence in the work sphere, men's presence in the home sphere has not increased (England, Privalko, & Levine, 2020). This inequality at home is sustained by cultural, often religion-grounded, ideologies that privilege men, and naturalize male entitlement to female family work, including caregiving. In fact, dominant ideologies and systems in the U.S. still support men being dispensed from household and family responsibilities, putting the onus on women to do most if not all housework, and to make adjustments in their paid employment to accommodate their husbands' (England et al., 2020; Killewald & Garcia-Manglano, 2016). As a result of these gender-biased ideologies and systems, women are not getting a full chance at paid employment, in science and non-science fields. As part of the patriarchal system, men also continue to be overpaid while women are underpaid, in whatever work they do (Cerrato, 2018; Charlesworth & Banaji, 2019). Due to gender-biased ideologies and systems, even in families where the wife has more powerful and well-paid employment, men do not do equal household and childcare work.(Bertrand et al., 2015).

Furthermore, it is a common finding across employment types and stages that women view, and treat childcare as their responsibility. Data shows that men in U.S., not just men in

science, do not view childcare as their responsibility (Laughlin, 2013). In the current study when the male scientists provided childcare, they still perceived themselves and were described by women as "helping," or being "supportive," while women were perceived as performing their mother's "duty," or "responsibility." There is also a difference in the kind of child caregiving that women versus men provide. Studies of women and men across employment indicate that women provide the practical childcare, while men do recreational activities with their children (Ponthieux & Meurs, 2015; Sayer, 2005). On average, mothers spend 60% of childcare time in supervision and physical care, and only 27% on recreational and education activities while fathers spend 45% of childcare time on supervision and physical care, and 41% on recreational activities (Ponthieux & Meurs, 2015).

Limitations and Directions for Future Research

This study focused on the work, marriage and parenting views, goals, expectations and experiences of female and male graduate/post-graduate scientists in ATS. These scientists were married and had or were expecting children by time 2 in the study.

There are several limitations to this study. First, participation in the study was voluntary. Therefore, it is possible that the individuals who self-selected to participate were ones that experienced more difficulties or were more concerned about issues of work-family interface.

Second, only one individual of the couple was interviewed. The researchers had one side of the story. As a result, they may have not become aware of factors that may have contributed to the interviewees' views, goals, expectations, and experiences. In order to avoid this limitation, it is recommended that future studies collect data from both individuals in the couple.

A strength of this study was that it focused on one field, ATS. Different science fields have different demands for women and men at the graduate school level and beyond, in ways

that may impact their work and family experiences. Future studies could apply a qualitative method to studying other science fields to better understand unique factors in fields other than ATS.

This study's findings suggest that there may be unique factors and circumstances related to being in the graduate and early post-graduate stages that contribute to the underrepresentation of women in ATS academia. Therefore, focusing future research on specific points in time of a scientist's training (e.g., graduate stages vs. undergraduate) might yield information that is pertinent to that specific stage of training and that might not be visible if multiple stages are combined. Further, this study highlighted the importance of taking a longitudinal perspective when examining work-family issues. It made visible how work-family issues evolve over time.

The current study's and previous research findings point to two factors that may contribute to women underrepresentation in leadership roles in ATS and in other sciences, especially. The first is that women are expected to contend with, if not prioritize their husband's employment. The second is that they are still expected to be the primary caregiver to their children. Quantitative survey methods could be used to explore questions of work and family by using a larger purposive sample of female and male scientists in different fields.

This study was conducted by individuals who are themselves scientists or scientists in training, and that therefore have personal experience with many of the issues of this study. These are individuals who are also professionally trained in the social sciences literature on women, men and gender. The researchers' personal experiences with the study's topic could be a liability in that the personal experiences may have led the researchers to respond to the data more in terms of their personal frames than the participants' frames. This is however true of any research, whether qualitative or qualitative. Overall, the researchers' personal and professional familiarity

with the topic was a strength. One reason is that the researchers brought lived experience and scholarly frameworks and insights to the study. For example during the coding stage, since the coders had an insider view into those issues, they were sensitive to nuances in the responses provided by the participants.

For this study, the coders documented their personal views, goals, expectations, and experiences with science and academia prior to beginning the study. They also recorded their personal reactions to the transcripts and discussed them in coders meetings. For example, one coder commented on her frustration that a male participant who had a child with medical needs did not mention until later in the interview the sacrifices his wife made in order to care for the child. Another reflection was about the pattern of female scientists prioritizing their husbands' career. The coders' personal reactions to what female and male scientists said in the interviews were discussed in coder meetings. Coders evaluated together how their interpretations of the data was true to the content of the interview. During coding meetings it was not uncommon for the researchers to share family and work issues they had experienced. In my view, the personal reflections and conversations helped the researchers better understand what the participants were experiencing or trying to convey. Future qualitative studies may consider adopting and expanding on this study's reflexivity protocol.

Chapter 5: Conclusion

The findings of this study, along with those of past research, show that female and male scientists are not on a level playing field when it comes to work and family. Female scientists expect but also realize that given work and family norms and systems that privilege men, a career as a leader in science and having a family is very difficult for women.

This study filled in some of the gaps in knowledge by including male scientists. It made visible that male scientists do not experience tensions between work and family due to a systemic alignment, in terms of norms and practice, in male career and family goals. In stark contrast to the sense of responsibility and burden that the female scientists described, male scientists talked about their children as a reprieve from work and a source of fun. The findings of this study and prior studies indicate that female scientists tend to look for flexibility in their work, and permanence in their home life--to allow more energy and time for family. In contrast, male scientists strive for permanence in their work life and seek flexibility in their home life--to allow them to invest in work and in the financial provider role.

This study expanded on previous research by taking a longitudinal approach . The longitudinal method allowed exploration of how female and male scientists' views, goals, expectations, and experiences evolved over time and in what direction. Findings suggests that overtime female scientists invest more time into their family life. On the other hand, male scientists invest more time into their work life. This disparity in investments increases once female and male scientists have children.

This study's findings are consistent with those of studies that explored similar issues in a variety of fields. Collectively, studies indicate that women are expected to take on employment

and family caregiving responsibilities, while men can focus on being the primary provider and choose if, when, and how much to engage in childcare responsibilities (Beddoes & Pawley, 2014; Hughes, Schilt, Gorman, & Bratter, 2017).

Overall, findings of this and other studies suggest that female scientists opt out of leadership roles in science not by choice, but because of systemic biases, barriers, and burdens at work and in the family, including gendered expectations about caregiving. Progress in women's representation in science leadership will likely continue be stunted as long as women are expected to, and provide most, if not all the family childcare.

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Appendix A: Questionnaire Time 1 Selected Questions

3. Age:_____

4. Sex: _____

5. Current Relationship Status:

___Single and Unattached

___Single and Attached

___Married/Commitment Ceremony

6. Please describe your current living situation:

___living alone

___living with romantic partner

___living with roommate(s) → please specify relationship (e.g., close friend)_____

___living with relative(s) → please specify relationship (e.g., sister)_____

___other → please specify

_____

7. If currently in a committed relationship, how long have you been in a relationship with this person? _____

8. If currently in a committed relationship, please provide the following demographic information **for your partner**:

Age: _____

9. Check if you have ever been:

Divorced: ___yes Widowed: ___yes

___no ___no

10. If currently in a committed relationship, indicate your partners' current employment status and indicate the number of hours for each line checked:

___Employed Part-time → Average number of hours per week _____

___Employed Full-time → Average number of hours per week _____

___Not Employed

11. If currently in a committed relationship, please indicate whether or not your partner is a student, and his/her average number of credits per semester:

___Student Part-time → Average number of credits _____

___Student Full-time → Average number of credits _____

12. If you checked "Employed Part-time" or "Employed Full-time" on question #10, what does your partner do for work? _____

13. If you checked "Student Part-time" or "Student Full-time" on question #11, what does your partner study? _____

14. Do you have children?

___yes

___no

15. If you answered "yes" to #14, please indicate age, sex, and living arrangements for each child:

16. If you are currently in a committed relationship, does your partner have children from a previous relationship?

___yes

___no

17. If you answered "yes" to #16, please indicate age, sex, and living arrangements for each child:

18. If you currently have at least one child living in the home, please estimate the average number of hours per week (excluding time in school) that someone *other than you* provides childcare: _____

19. If you do not currently have children, do you plan to have children? (please check one)

___definitely yes

___probably yes

___probably no

___definitely no

Cultural Background Information:

26. What is the career that you plan to pursue after graduation?

_____

Education:

38. Current Level in School (please check one):

____ First Year Undergraduate

____ Second Year Undergraduate

____ Third Year Undergraduate

____ Fourth Year Undergraduate

____ Fifth Year or higher Undergraduate

____ Master's Program

____ Doctoral Program

____ Professor

____ N/A

39. Indicate number of years in current program (or years teaching): ____

40. If you are currently enrolled in a master's or undergraduate program, do you think you will continue your education in this field to earn a Ph.D.?

___definitely yes

___probably yes

___probably no

___definitely no

___N/A

43. Please indicate your current student status and indicate the average number of credit hours you enroll in per semester*:*

___Part-time Student → Estimated number of credits _____

___Full-time Student → Estimated number of credits _____

___N/A

Appendix B: Questionnaire Time 2 Selected Questions

Date: _____ Current/Former Institution (School): _____

Current/Former Program (Dept.):_____

Circle one: Ph.D. M.S. B.S. Faculty

Research Scientist Post-Doc

(If you have your M.S. and are working on your Ph.D., circle Ph.D.)

Current Position/Company:_____

3. Age:_____ 4. Sex: _____

RELATIONSHIP INFORMATION:

5. Current Relationship Status:

___Single and Unattached

___Married/Commitment Ceremony

___Single and Attached

6. Check if you have ever been:

Divorced: ___yes Widowed: ___yes

___no ___no

7. Please describe your current living situation:

___living alone

___living with romantic partner

___living with roommate(s) → please specify relationship (e.g., close friend)_____

___living with relative(s) → please specify relationship (e.g., sister)_____

___other → please specify

_____

8. If currently in a committed relationship, how long have you been in a relationship with this person?: _____

Partner Information:

9. If currently in a committed relationship, please provide the following demographic information **for your partner**:

Age: _____ Citizenship: _____

(please indicate dual citizenship, if applicable)

10. If currently in a committed relationship, please indicate whether or not your partner is a student, and his/her average number of credits per semester:

___Student Part-time → Average number of credits _____

___Student Full-time → Average number of credits _____

___On Leave

___Graduated

11. If you checked "Student Part-time" or "Student Full-time" on question #10, what does your partner study? _____

12. If currently in a committed relationship, indicate your partners' current employment status and indicate the number of hours for each line checked:

___Employed Part-time → Average number of hours per week _____

___Employed Full-time → Average number of hours per week _____

___Student RA/TA/Other Assistantship → Estimated number of hours per week _____

___Not Employed

13. If you checked "Employed Part-time" or "Employed Full-time" on question #12, what does your partner do for work (Do not include assistantship)?

_____

PARTICIPANT INFORMATION:

Cultural Background Information:

18. What is the career that you plan to pursue after graduation?

_____

Education:

26. Please indicate your current student status and indicate the average number of credit hours you enroll in per semester:

___Part-time Student → Estimated number of credits _____

___Full-time Student → Estimated number of credits _____

___On Leave

___Graduated

28. Current Level in School (please check one):

____ First Year Undergraduate

____ Second Year Undergraduate

____ Third Year Undergraduate

____ Fourth Year Undergraduate

____ Fifth Year or higher Undergraduate

____ Terminal Masters Program

____ Combined Masters/Ph.D. Program (you earn a Master's on your way to a Ph.D.)

If so, currently working on: Masters ____ or Ph.D. ____

____ Doctoral Program

____ Graduated/Employed (If yes, what is your position?)

_____

____ Graduated/Not Employed

29. How long have you been in your current program/job (in years): _____

30. If you are currently enrolled in a Masters or undergraduate program, do you think you will continue your education in this field to earn a Ph.D.?

___definitely yes

___probably yes

___probably no

___definitely no

Family information:

36. Do you have children (excluding stepchildren)?

___yes

___no

37. If you answered "yes" to #36, please indicate age, sex, and living arrangements for each child:

			Avg. number of days per week
	Age	***Sex***	***the child lives with you***
1.)	_____	____	_____
2.)	_____	____	_____
3.)	_____	____	_____
4.)	_____	____	_____
5.)	_____	____	_____

(continue on reverse if necessary)

38. If you are currently in a committed relationship, does your partner have children from a previous relationship?

___yes

___no

39. If you answered "yes" to #38, please indicate age, sex, and living arrangements for of your partner's children:

			Avg. number of days/week
	Age	***Sex***	***the child lives with you***
1.)	____	____	_____
2.)	____	____	_____
3.)	____	____	_____
4.)	____	____	_____
5.)	____	____	_____

(continue on reverse if necessary)

40. If you currently have at least one child living in the home, please estimate the average number of hours per week (excluding time in school) that someone *other than you* provides childcare: _____

41. If you do not currently have children, do you plan to have children? (please check one)

___definitely yes

___probably yes

___probably no

___definitely no

Appendix C: Selected Relevant Variables from Interview Questions Time 1

Questions about challenges

Individual factors:

1. What are the biggest challenges you have faced so far? (FIRST ALLOW THEM TO ANSWER UNPROMPTED, THEN GO THROUGH ONE AT A TIME)
    a. Economic
    b. Interpersonal
    c. Family
    d. Relationships
    e. Health
    f. Social expectations
    g. Time
    h. Self Image
2. How do you cope with setbacks you encounter in life in general and in your *Atmospheric Sciences* training in particular?
    i. How did you learn/develop these coping strategies?
3. Who are the major sources of support for you in dealing with such setbacks?
4. Have you ever considered switching majors/careers, and if so, why?
    j. How difficult would it be for you to give up your current field of study and/or career aspirations and what factors could lead you to make such a change?

Relational factors:

5. If you are currently in a romantic relationship, describe how this partnership enhances and how it challenges your educational and career goals. If not currently in a romantic relationship, describe how you envision such a partnership enhancing or challenging your career goals, based on past experience or observation of others.
    k. At what career stage is your partner? How do you think this has influenced/may influence your education and future career plans?

6. Do you have, or plan to have, children? How do you think these plans have been or will be affected by your career choice?

Institutional/societal factors:

7. What do you plan to do in terms of future education and career within the field of <u>*Atmospheric Sciences*</u> and what are the biggest challenges to achieving these goals that you think you may face in the future?
    l. For MS students: Do you plan to complete a Ph.D. after you finish your M.S.? What factors have affected/will affect this decision?
    m. Discuss the differences in the challenges you think you have faced/will face in your academic career versus your career after graduation.

Appendix D: Selected Relevant Variables from Interview Questions Time 2

ATS Follow–Up Interview

Education and Career

Current and Past Education and Career

1. What currently are your main school experiences or issues?
    a. How has this changed or remained the same in the past year?
    b. Beyond the past year, how has this changed or remained the same?

2. What currently are your main work experiences or issues?
    a. How has this changed or remained the same in the past year?
    b. Beyond the past year, how has this changed or remained the same?

Future Education and Career Plans

3. What are your future plans for your education?
    a. Has this changed from what you were planning a year ago?
        i. If so, how has it changed? And what factors contributed to this change?
        ii. If not, what do you think supports this current direction?
    b. Think back to over a year ago, have there been any changes in your education plans?
    c. What do you think are challenges or barriers for your future plans for education?
    d. What are resources that you think contribute to achieving your educational goals?

4. What are your future plans for your career path?

a. Has this changed from what you were planning a year ago?
    i. If so, how has it changed? And what factors contributed to this change?
    ii. If not, what do you think supports this current direction?
b. Think back to over a year ago, have there been any changes in your career path?
c. What do you think are challenges or barriers for your career goals?
d. What are resources that you think contribute to achieving your career goals?

Support Networks

I am now going to ask you a little about your social supports/support networks:

5. Who currently are the individuals and groups most supportive of your career path? How do they support you? (Give example of types of groups if it is unclear)

Personal Relationships

I am now going to ask you some questions about your personal relationships and your family as they pertain to your education and career:

6. REFER TO DEMOGRAPHICS FORM QUESTIONS 5 TO DETERMINE IF THE FOLLOWING QUESTION IS APPLICABLE.
    a. (If in relationship) What would you say about how your relationship with your partner impacts your education or career path or vice versa?
    b. (If not in a relationship) How do you think romantic relationships may impact your education or career path or vice versa?

7. SEE DEMOGRAPHICS FORM QUESTION 37-39 TO DETERMINE WHICH OF THE FOLLOWING QUESTIONS ARE APPLICABLE

a. (If have children) How has having children impacted your education or career path?

b. (If don't have children) Do you have plans to have children?

    i. How do you think these plans have been or will be affected by your education or career path?