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Do Labmates Matter? The Relative Importance of Workplace Climate and Work-Life Satisfaction in Women Scientists' Job Satisfaction

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ABSTRACT

Workplace climate and work-life balance are two factors that influence women's decisions to leave or remain in a science workplace. This study applies structural equation modeling to data from nearly 600 early-career geoscientists to examine relationships among perceptions of workplace climate, work-life satisfaction, job satisfaction and productivity. The results include analytic path models comparing women to men, women professionals to women graduate students, and women professionals with child caregiving responsibilities to those without. For all groups, workplace climate—measured in terms of both collegial interactions in the workplace and influence on decision-making—outweighed satisfaction with work-life balance in shaping job satisfaction, which in turn positively influences perceived productivity. Work-life balance increased in importance and became significantly more influential for women caregivers. The findings suggest that institutional efforts to improve workplace climate benefit all, while unmitigated work-life conflict may tip the balance for women's satisfaction.

KEYWORDS

women; STEM; geoscientists; workplace climate; work-life satisfaction; job satisfaction

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INTRODUCTION

Women are disproportionately less represented in scientific professions despite increased numbers of women receiving advanced training in these disciplines (NSF, 2013). Within science, technology, engineering and mathematics (STEM) workplaces, they are over-represented in low-status institutions, low-status positions, and part-time work, advance less rapidly, are paid more poorly, and are more likely to leave for other types of work (NSF, 2013; Preston, 2004; Xie & Shaumann, 2003). In seeking explanations for these discrepancies, some research has addressed the role of implicit bias (Valian, 1999) in evaluating women for jobs, promotions, and awards (e.g., Correll, Benard & Paik, 2007; Lincoln, Pincus, Bandows Koster & Leboy, 2012; Moss-Racusin, Dovidio, Brescoll, Graham & Handelsman, 2012; Reuben, Sapienza & Zingales, 2014; Steinpreis, Anders & Ritzke, 1999), thus focusing on impediments to women's advancement.

Another body of research has addressed why women depart from STEM career paths in science, technology, engineering and mathematics (STEM). Much of this latter work has focused on how work-life issues and workplace climates influence women's departure decisions (Bilimoria, Joy, & Liang, 2008; Bozeman & Gaughan, 2011; Callister, 2006; De Welde & Laursen, 2011; Gardner, 2012; Holmes & O'Connell, 2007; Mason & Goulden, 2002; Ponjuan, Conley, & Trower, 2011; Sabharwal & Corley, 2009; Settles, Cortina, Malley & Stewart, 2006; Shollen, Bland, Finstad, & Taylor, 2009; Xu, 2008). Research has shown that in the male-dominated workplaces commonly found in STEM disciplines, women perceive workplace climates to be cold and unwelcoming. They report feeling isolated and experiencing intentional and unintentional discrimination and gender-based microaggressions (Capodilupo et al., 2010). For women of color, all these challenges may be amplified by the simultaneous double bind of sexism and racism (Ong, Wright, Espinosa & Orfield, 2011). These feelings have practical consequences: women in STEM disciplines report lower levels of job satisfaction and are more likely to leave their jobs than are their male counterparts and non-STEM women professionals (Preston, 2004). Workplace climate has been linked to performance, job satisfaction and retention, both in general work environments (Carr, Schmidt, Ford & DeShon, 2003; Parker et al., 2003) and for women in academe (August & Waltman, 2004; Xu, 2008).

Especially in early career stages, many women scientists face competing pressures on advancing their careers—completing graduate degrees, embarking on a professional path, and, in academia, earning tenure—and creating and caring for families. This conflict is compounded when work demands such as working long hours interfere with the demands of personal life. Difficulty in balancing work and personal life demands has been linked to low job satisfaction and higher likelihood of leaving STEM jobs or career paths, especially in the case of women with young

families (Holmes & O'Connell, 2007; Ponjuan, Conley, & Trower, 2011; Mason & Goulden, 2002, 2004; Wolfinger, Mason, & Goulden, 2008). Among faculty, the impact of these decisions is amplified as women graduate students in STEM fields make decisions about their own career choices based on their often-negative perceptions of the work and especially the lives of faculty in their departments (De Welde & Laursen, 2011; Mason, Goulden & Frasch, 2009; van Anders, 2004).

This study examines women scientists' job productivity and job satisfaction and how these are related to workplace climate and work-life pressures. We focus on early-career women geoscientists who work in academic and research settings, most often in the US and make comparisons between women and men, and among women with different career and personal commitments. By investigating not just these career-related perceptions, but possible differences from group to group in how these perceptions influence one another, we contribute to understanding how these factors may shape women scientists' experiences, advancement and career decision-making in STEM workplaces. These experiences are especially important early in women's career paths when they are most likely to make decisions to remain in a STEM field or to pursue other work.

THEORETICAL FRAMEWORK

In this study, we introduce a model to explain relationships between scientists' satisfaction with their work-life balance and workplace climate to their job satisfaction and self-reported productivity. We then apply the model to examine how these relationships vary by gender, career stage, and caregiving responsibility. Our framework for the study draws from the literature in organizational psychology, which has produced scores of studies documenting the effects of workplace climate and work-life balance on a variety of employee outcomes, including job satisfaction, productivity, and retention (for reviews, see Carr et al., 2003; Parker et al., 2003).

Workplace Climate

Workplace climate, also named in the literature as department climate, psychological climate, collective climate, organizational climate, and organizational culture, is a multi-dimensional construct describing shared perceptions of both formal and informal organizational norms and practices (Carr et al., 2003; Parker et al., 2003). Climate is seen as an important mediator of individuals' behavior within organizations, but it is not consistently defined, represented theoretically, nor operationalized and measured. Indeed, there has been some difficulty in establishing the boundaries of this concept, as revealed by a meta-analysis by Parker et al. (2003): "Virtually every aspect of their work environment, including the characteristics of their jobs, physical environment, supervision, top management, and co-workers, have been included in psychological climate research."

Several researchers have introduced higher-order climate variables to collapse dimensions of climate into more manageable categories. A meta-analysis by Carr et al. (2003) utilized a taxonomy proposed by Ostroff (1993) to categorize facets of climate into three higher-order dimensions. This meta-analysis found the strongest

relationship between job satisfaction and the affective dimension of climate, which addresses social and interpersonal interactions with co-workers, such as warmth, cooperation, participation in decision-making, and social rewards. The cognitive dimension of climate addresses individuals' involvement in work activities, including growth, innovation, autonomy and intrinsic reward, while the instrumental dimension addresses task involvement or "getting things done," and includes hierarchy, structure, achievement, and extrinsic rewards. Across the literature both these latter dimensions showed weaker relationships to job satisfaction.

Similarly, Jones and James (1979) provide a model with five dimensions of climate. Another meta-analysis (Parker et al., 2003) used this framework, and again found a clear link between measures of workplace climate and individuals' attitudes, motivation and performance. Moreover, the "work group" dimension of climate had the greatest influence on overall climate of these five dimensions. This dimension reflects interactions with others within the work group. Influence and involvement in decision-making within the work unit have been identified as key to work group interactions and are strongly related to morale and satisfaction for academic workers in particular (Rice & Austin, 1988). Collegiality is another important dimension of the workplace climate for academics in particular (Austin, 1990; Campbell & O'Meara, 2014, and references therein).

Work-life Balance

Similar to workplace climate, work-life balance is a vague construct with little agreement on what exactly it constitutes or how it should be operationalized and measured. The interface between work and personal life has been described by nearly synonymous concepts, including work-life balance, work-family conflict, and work-life conflict. Regardless of nomenclature, work and personal lives are conceived to be separate and in conflict with each other (Guest, 2002). The term "balance" is highly subjective and is heavily influenced by personal characteristics (e.g. having a family) and workplace settings (e.g. people who work from home). Work-life balance has been defined as "satisfaction and good functioning at work and at home with a minimum of role conflict" (Clark, 2000).

A commonly used framework for studying work-life balance is the spillover model (Amelink & Creamer, 2007; Guest, 2002; Sorcinelli & Near, 1989). In this conceptualization, aspects of personal life, such as caretaking responsibilities, may interfere with work commitments, while commitments such as work-related travel may interfere with personal or family life. For academics, the "ideal worker" norm of high commitment to academic work and, at least in the US, the finite deadline posed by the tenure and promotion clock may impose particular work-life pressures, while the high flexibility and autonomy of academic work provides faculty with agency to address the practical challenges (Grant, Kennelly & Ward, 2000; Ward & Wolf-Wendel, 2004).

Much of the literature on work-life balance focuses on the impact of institutional work-life practices on organizational outcomes rather than an employee's evaluation of her own work-life balance (Beauregard & Henry, 2009). For example, it is common to measure how availability or use of work/life initiatives (e.g.

flextime, teleworking, childcare assistance) improve organizational outcomes such as productivity or absenteeism. We elected instead to measure individuals' work-life satisfaction for several reasons.

First, we seek to compare the relative effects of workplace climate and work-life balance satisfaction on job satisfaction, recognizing that what is satisfactory varies by individual, by institution, and over time. For example, pressure to work long hours may lead to dissatisfaction for some, while for others effective work-life practices might provide satisfaction with work-life balance despite long work hours; for still others, the same practices may not meet individual needs and thus not affect satisfaction. Second, this study includes respondents from many institutions, each of which has different work-life practices and policies. Thus we use an independent or endogenous variable, "personal life spillover" that measures respondents' perceptions of how their personal life has negative effects on their career. Finally, prior research has shown that individual differences such as personality influence perceptions of work-life balance (Eby, Casper, Lockwood, Bordeaux, & Brinley, 2005; Ford, Heinen, & Langkamer, 2007). Due to this subjective nature of work-life balance, an individual's evaluation of work-life balance is a more valid measure for assessing links to other perceptions, such as job satisfaction.

Multiple Influences on Job Satisfaction

Overall, our study examines the relative weight of these factors on scientists' job satisfaction and productivity. Most prior studies focus on faculty only; many previous studies have probed for group differences in job satisfaction or examined individual influences on job satisfaction, but have not examined relationships among multiple possible sources of job satisfaction. For example, Bozeman and Gaughan (2011; also see references therein) found that women STEM faculty had lower job satisfaction than men; their data did not resolve family status and did not offer an explanation of this finding, though they note that women experience "different working conditions" that may include both workplace climate and structural issues that affect work-life conflict.

Many prior studies have examined gender and some of these have also included marital/partner status, but relatively few have also included parental status as a factor in job satisfaction. For example, married faculty typically express higher levels of job satisfaction than unmarried colleagues (Hagedorn, 2000), which is explained in terms of greater psychological support, encouragement, division of labor at home, and reduced feelings of isolation. Studies that do take family composition into account, such as that by Jacobs and Winslow (2004) have focused more tightly on dissatisfaction with workload for faculty with families. As they point out, work-life issues are not restricted to women. Sabharwal and Corley (2009) examined job satisfaction as a function of multiple institutional and career-status variables, such as employer size and funding sources, but considered no variables that measured respondents' perceptions of their workplace environment.

Among studies that examine multiple and perceptual influences on job satisfaction, Callister, Minnotte and Sullivan (2009) used gender differences in interview data to

argue that colleagues and work/personal issues were more often sources of job dissatisfaction for women academics in STEM fields. However, their data do not make it possible to compare the magnitude or importance of these sources. Britton et al. (2012) found that the single most important factor in predicting job satisfaction for both STEM and non-STEM faculty was feeling valued and respected in one's department; this outweighed measures of work and family spillover. Bilimoria and coauthors (2006) found that the "internal relational supports" offered by a respectful and inclusive immediate work environment were more important to women faculty than to men, and a greater influence on women's overall job satisfaction. Their path analysis compared these with other institutional resources and factors such as leadership, but did not consider personal or family situation and its potential conflict with work. Likewise, Settles et al. (2006) found a positive relationship of departmental climate to STEM academic women's job satisfaction and career outcomes but did not examine factors outside the workplace.

Overall, prior work has shown that work-life issues and workplace climate are related to productivity and job satisfaction, and that these relationships differ for men and women in science and across the academe, but does not make clear the nature and strength of relationships among these multiple constructs. Moreover, the literature contains many assertions about the importance of work-life issues to women that do not carefully distinguish between gender and family caregiving status but rather assume that caregiving roles are inherently gendered.

PURPOSE

In this paper, we examine work-life satisfaction and workplace climate as determinants of job satisfaction among early-career women geoscientists. More specifically, we address the following research questions:

- Do women scientists differ from men in their perceptions of job satisfaction, work-life satisfaction, workplace climate, and other variables in our model?
- Is workplace climate more or less predictive of job satisfaction than work-life balance?
- How do the relationships between department climate, work-life balance, job satisfaction and productivity vary by gender, career stage, and parenting responsibilities?

METHODS

Here we describe the sample, measurements, and analytic approach, and justify the measurement model that underlies the structural equation models.

Sample

The sample came from two online surveys administered in 2010 to participants in the Earth Science Women's Network (ESWN), an international professional network whose members are primarily early-career female geoscientists. ESWN provides its members with career support and mentoring through workshops, conference-based events, and an active e-mail listserv. The network is international but most members are based in the United States. ESWN members (all women) were invited

through the listserv to complete the survey; after three follow-up reminders over about six weeks, we received 489 complete responses from an estimated population of 1000 members for an approximate 49% response rate.

Additional survey responses were obtained from members of a geoscience job-focused listserv run by ESWN, with unknown populations of men and women. Out of 171 respondents, 81 responses could be used in the analysis: 72 from men and 9 from women who were not also ESWN members. Many respondents had previously completed the survey sent out via the ESWN listserv, while others omitted demographic information that was necessary for group comparisons. Approximately 60% of the female respondents were ESWN members who also subscribed to the listserv. We found no statistically significant differences in the proportions of men and women who were graduate students, were married, or had caregiving responsibilities, nor by age group or education level.

Of the overall sample, 86% were 40 years of age or less; the graduate students were on average younger (74% were 21-30 years old) than the professionals (83% were 31 or older). A majority of 75% worked in academic positions, including postdocs and graduate students as workers in research groups. Most of the rest worked in professional research or management positions, many in government labs or agencies. We found no statistically significant differences in the proportions of respondents who worked in academic and non-academic workplaces for any group comparison, except for career stage where all graduate students worked within academic institutions, compared to 71% of female professionals.

Many respondents also had families: 76% had a partner and 32% had a child at home, mostly pre-school age. Respondents' family situations did not differ notably by workplace: 31% of women who worked in academic workplaces had child caretaking responsibilities as did 37% of women who worked in non-academic workplaces. A majority (86%) were US citizens or permanent residents. Most respondents were white or of European descent. Respondents were highly educated; of the professional (non-student) scientists, 89% held a Ph.D. On the whole, the sample reflects the status of women geoscientists, primarily those early in postbaccalaureate career paths in academic and research settings.

Variables Measured

As shown in Table 1, the survey included composite scales to measure latent variables. We adapted items from existing measures of workplace climate that were developed for single-institution surveys, primarily in academic environments (CSHPE & CEW, 1999; Stewart, Stubbs & Malley, 2002; Study of Faculty WorkLife, 2006). These were adapted for a wider range of geoscience workplaces. The items aligned well with the affective dimension in the Ostroff (1993) taxonomy and the work group dimension used in the Jones and James framework (1979). Specifically, we examine social interactions with colleagues? and influence in decision-making. In a preliminary exploratory factor analysis, we removed two items from the interactions dimension and two items from influence dimension to improve the reliability of these constructs. In the current analysis we used the four

items to represent the interaction dimension (α= 0.84) of workplace climate and the five items to represent the influence dimension of workplace climate (α= 0.88).

Table 1: Construction of Latent Variables

Latent Variables	Observed Variables	Chronbach's Alpha
Job Satisfaction		
	How satisfied are you in your current job?	single item
Long Hours		
	Working long hours is an important sign of commitment in my workplace.	single item
Work/Life Satisfaction		0.79
	I am usually satisfied with the way in which I balance my professional and personal life. How satisfied are you with the balance between professional and personal life?	
Productivity		0.78
	How would you rate your overall level of productivity compared to others in your unit? How do you think your work unit views your productivity, compared to the unit average?	
Personal Life Spillover		0.82
	I often have to forego professional activities (e.g. sabbaticals, conferences) because of personal responsibilities. Personal responsibilities and commitments have slowed down my career progress.	
Interaction		0.84
	I feel like I "fit" in my work unit. I feel isolated in my work unit. How satisfied are you with [the] amount of social interaction with members of [your] unit How satisfied are you with [the] level of intellectual stimulation in [your] day-to-day contacts with colleagues	
Influence		0.88
	I feel like a full and equal participant in my unit's problem-solving and decision-making. I have a voice in how resources are allocated. Meetings allow for all participants to share their views. Tasks are rotated fairly to allow for participation by all colleagues. My unit head involves me in decision-making.	

Because we were interested in perceptions of the workplace environment and their impact on women's careers, and because no external productivity measure would carry the same meaning across all the career stages and types represented in our

sample, we used a self-report productivity measure. Such measures have been shown to correlate with objective or external measures, particularly when the latter are quantifiable (Bommer, Johnson, Rich, Podsakoff & MacKenzie, 1995). To further mitigate issues with leniency in self-report, we asked respondents to report their productivity confidentially on a relative scale that was framed in terms of others' perceptions in relation to the respondent's peers (Schoorman & Mayer, 2008; Cascio & Aguinis, 2011). We also asked respondents to identify the important indicators of productivity in their field; the top indicators were highly consistent across respondents as well as highly quantifiable (articles, grants, conference presentations) (Archie & Laursen, 2013). Further details about the survey conditions and items are found in Archie and Laursen (2013).

Typically, latent variables are derived from three or more observed variables, however, research has shown that the use of one- or two-item latent variables is acceptable, albeit not preferred (Hayduk & Littvay, 2012). Three latent variables were measured by two items each: productivity (α= 0.78), work-life satisfaction (α= 0.79), and personal life spillover (α= 0.82). Job satisfaction and expectations for working long hours were single-item variables, thus no reliability coefficients were computed. We chose not to include additional items on some constructs to limit the overall length of the survey, which included a large number of items used for purposes other than the climate study reported here.

Analytic Approach

The analysis had two main thrusts: a comparison of means of composite items by gender, career stage, and caretaking responsibilities, and a comparison of the relationships between variables in a model, again by gender, career stage, and caretaking responsibility. First, using IBM SPSS 20, we computed item means from composite scores for each of the constructs identified above and used ANOVA to compare means across groups. Results of this analysis emphasize group differences in perceptions of job productivity, satisfaction, and contributing factors.

Second, we compared the relationships between the variables of interest using multi-group structural equation modeling (SEM). We specified a model consistent with theory and research findings outlined previously. Because of the multi-dimensional nature of workplace climate, we utilized a second-order structural equation model to represent workplace climate, with workplace climate represented by two latent indicators: interactions and influence. Results of this analysis emphasize differences in how groups report the *relationships* among job productivity, satisfaction, and influences such as workplace climate and work-life balance. We used the statistical package IBM AMOS 20 to perform SEM using maximum likelihood estimation. Performance of the SEMs was evaluated using several goodness-of-fit indices including chi square statistics, comparative fit index (CFI), and the root mean square error of approximation (RMSEA). The CFI ranges from zero to one, with 1 indicating a perfect fit, values above 0.95 well-fitting, and values above 0.92 an acceptable fit. CFI difference tests are commonly used as an alternative to chi square difference tests in measurement invariance tests (Hu & Bentler, 1999). The CFI is sensitive to correlations in the data. If there are low

correlations, CFI is likely to be low as well. The CFI is not sensitive to sample sizes and may be useful for low sample sizes (Fan, Thompson, & Wang, 1999).

The RMSEA is an absolute measure of the model's badness of fit (per degree of freedom), with a value of zero indicating that the model perfectly fits a set of data. RMSEA values of 0.05 indicate close fit, and values of 0.08 indicate reasonable fit (Browne & Cudeck, 1993). Like the CFI, RMSEA is not sensitive to sample sizes and thus useful for small samples (Fan, Thompson, & Wang, 1999).

Measurement Model

We were particularly interested in possible differences in the relationships between model variables for different subgroups of the sample. But to make valid and meaningful comparisons of regression coefficients within each multi-group model, we must first establish that latent variables are measured similarly across each subsample, a property known as measurement invariance (MI). MI testing examines the equivalence of measured constructs across groups; it is a hierarchical process that must be done for each group comparison.

We tested measurement invariance for three group comparisons: gender, career stage, and caretaking responsibility. For each subsample, MI was tested using a multiple-group confirmatory factor analysis (CFA) of second-order latent variables as outlined by Chen et al. (2005). Measurement invariance typically involves chi square difference tests to measure statistical significance in multi-group comparisons. A non-significant difference between chi square statistics for subsequent invariance tests indicates invariance. Hu and Bentler (1999) argue that the CFI can also be used for invariance testing by calculating differences in the CFI between subsequent invariance tests. They recommend a cut-off value of 0.01, with larger differences indicating non-invariance. In this study, both chi square difference and CFI difference tests were used to check measurement invariance.

We used Meredith's (1993) classification to determine the level of invariance in the multi-group analyses and subsequently the suitability for comparing regression coefficients across group analyses. Meredith described three categories of invariance: "weak"—the factor loadings are invariant, "strong"—both factor loadings and measurement intercepts are invariant, and "strict"— measurement residuals are also invariant. There is consensus that at minimum, "weak" measurement invariance is necessary to make valid comparisons of structural components including regression coefficients.

Because we can demonstrate "weak" measurement invariance on all three group comparisons, it is valid to compare regression coefficients in the structural models for each group comparison (next section). Results of Chi square difference tests and CFI difference tests for all measurement invariance tests are shown in the Supplemental Material.

Structural Model

The overall model (n=570) yielded acceptable, but not excellent, statistics for goodness of fit. We then generated three separate multi-group comparison

structural models based on gender, career stage, and caretaking responsibilities. In the first multi-group SEM, we compared 72 men to 498 women. In the career stage SEM we compared 157 women graduate students to 311 women professionals. In the final SEM we compared 110 women professionals with caretaking responsibilities to 150 women professionals without caretaking responsibilities. In all of the multi-group comparisons, we conducted *z*-tests to determine statistical differences in regression coefficients between groups. For each SEM, we report standardized regression coefficients, goodness of fit statistics and the proportion of the variability in job satisfaction that is explained by the model.

RESULTS

As noted in the Methods section, we examined the data both for differences in mean perception of these job satisfaction indices, and for differences in the relationships among these perceptions. The results were compared by gender and, for women, by career stage, and by child caretaking responsibility.

Table 2 presents mean perceptions of job satisfaction and its correlates for each comparison group. Figures 1-4 depict path models that illustrate how the relationships among these variables may differ dependent upon individuals' gender, career stage, and child caretaking responsibilities. We first review the general overall model and present the three comparison models. To highlight general commonalities, we organize the results by construct: we first discuss similarities and significant differences in mean perceptions, then differences in their relationships as revealed by the path models. In the Discussion section, we highlight and interpret differences by demographic group.

Table 2. Latent Variable Reliability, Means, and Group Differences

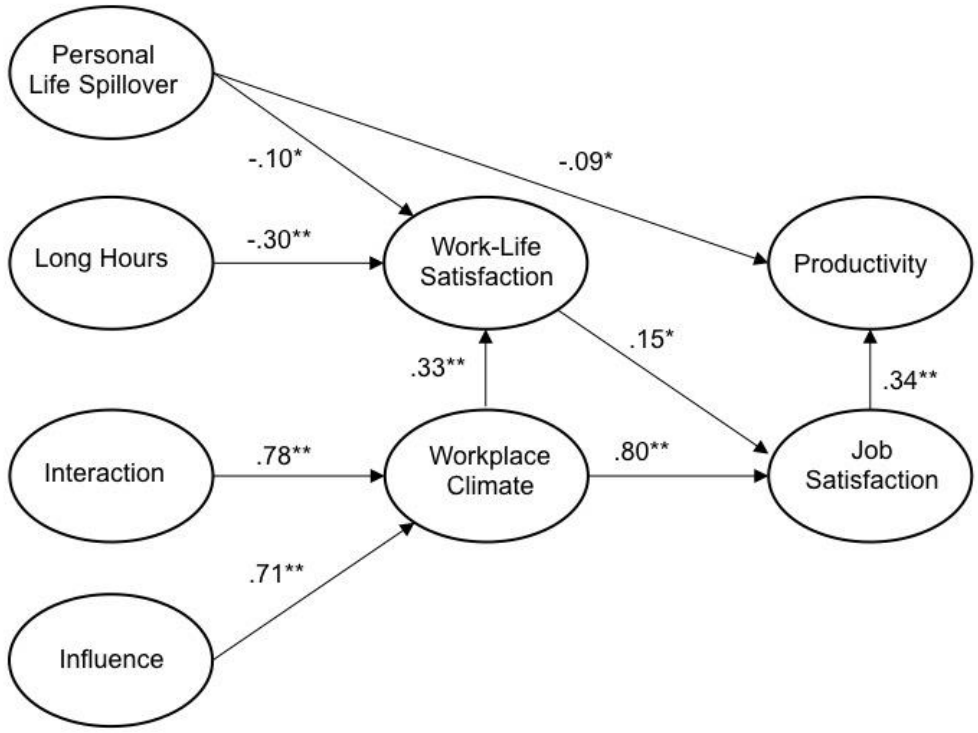
		Mean score					
		Gender		Career stage		Caretaking responsibilities	
Latent Variable	Reliability *Alpha*	Female	Male	Professional	Graduate Student	Child	No Child
Job Satisfaction	single item	3.24	3.37	3.27	3.19	3.22	3.31
Work-life Satisfaction	0.79	2.77*	3.00*	2.78	2.65	2.75	2.79
Productivity[1]	0.78	5.88*	6.38*	6.00**	5.47**	5.77*	6.19*
Long Hours	single item	2.70	2.55	2.68	2.80	2.73	2.65
Personal Life Spillover	0.82	2.16	2.20	2.25**	1.99**	3.13**	1.67**
Interaction	0.84	2.94*	3.18*	2.93	2.97	2.96	2.93
Influence	0.88	2.74**	3.02**	2.80*	2.62*	2.77	2.84

*$p \leq 0.05$
**$p \leq 0.001$
All items except Productivity coded on 4-point scale where 1=strongly disagree/dissatisfied, 2=disagree/dissatisfied, 3=agree/satisfied, 4=strongly agree/satisfied.
[1] This item was scored on a 10-point scale from 1= extremely unproductive to 10=extremely productive.

Overall Model

The overall structural model fit our data reasonably well (*CFI*= 0.95, *RMSEA*= 0.04) and explained a large proportion of the variance in job satisfaction (r^2= 0.73). Figure 1 shows the path model for the full sample, indicating a strong positive relationship between workplace climate and job satisfaction, but a minimal positive relationship between work-life satisfaction and job satisfaction. There was a moderate positive relationship between job satisfaction and productivity, and a direct, minimal negative relationship between personal life spillover and productivity. There was a moderate negative relationship between perceptions that working long hours was viewed as a sign of commitment and work-life satisfaction.

*Figure 1: Path Model of Full Sample (n=570). *p≤0.05, **p≤0.001, ns=not significant. CFI=0.94, RMSEA=0.04 (0.03-0.05)*



Likewise, the gender comparison model (Figure 2), the career stage comparison model (Figure 3), and the caretaking responsibility comparison model (Figure 4) all fit their respective data well (fit details are given in figure captions). All models also explained similar and substantial amounts of variability in job satisfaction (r^2= 0.70-0.81).

*Figure 2: Path Model Group Comparison based on Gender. *p≤0.05, **p≤0.001, ns=not significant. CFI=0.93, RMSEA=0.04 (0.03-0.06)*

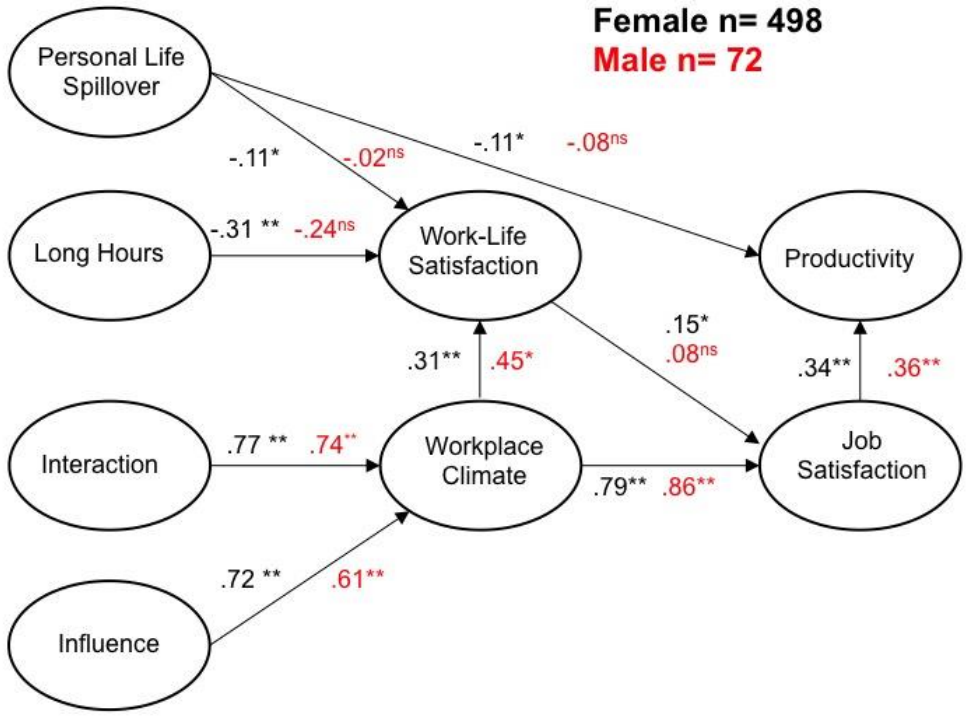


*Figure 3: Path Model Group Comparison based on Career Stage (females only). *p≤0.05, **p≤0.001, ns=not significant. CFI=0.94, RMSEA=0.04 (0.03-0.05)*

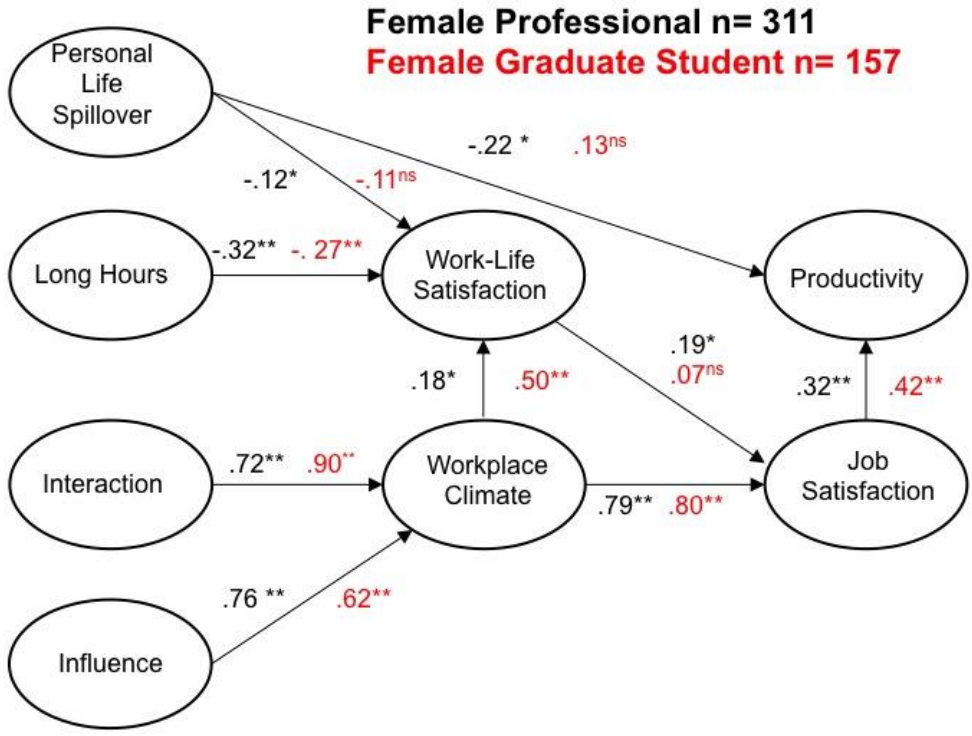
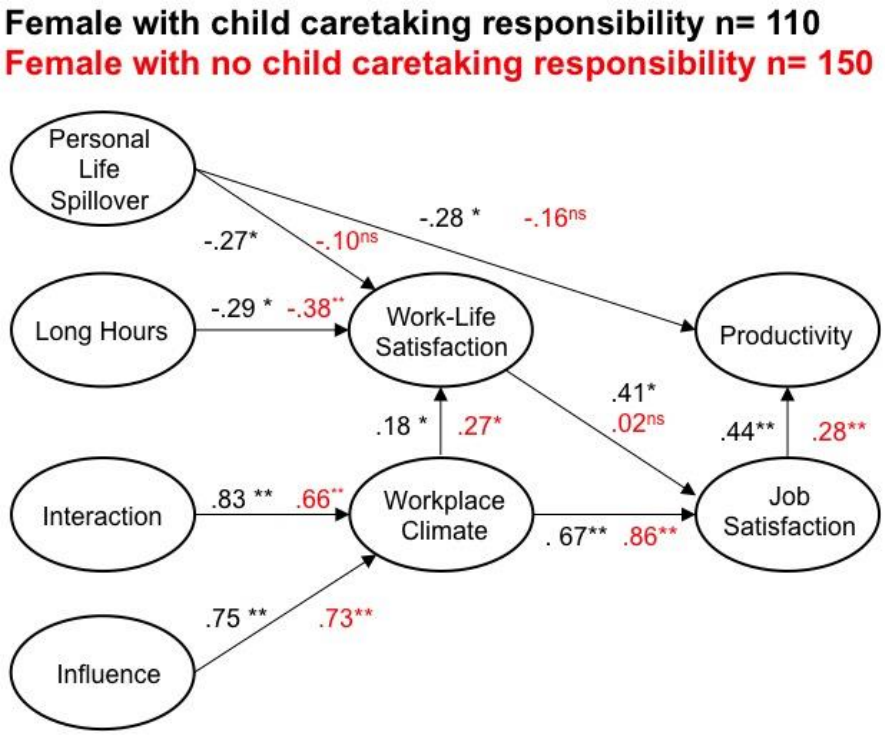


*Figure 4: Path Model Group Comparison based on Child Caretaking Responsibilities (female professionals only). *p≤0.05, **p≤0.001, ns=not significant. CFI=0.93, RMSEA=0.04 (0.03-0.05)*



Productivity

We found several statistical differences in mean scores of productivity across all three group comparisons (Table 2). Men rated themselves higher in productivity than did women, women professionals higher than graduate students and women without child caretaking responsibilities higher in productivity than those with child caretaking responsibilities.

Across all group comparisons (Figures 2-4), we found several relationships in the model to remain relatively constant across all group comparisons. There was a positive moderate relationship between job satisfaction and productivity, with standardized regression coefficients ranging from 0.28-0.42. In addition, there was a minimal to moderate negative effect of personal life spillover on productivity for women professionals (Figure 3), and for women professionals with caretaking responsibilities (Figure 4). This relationship was weak and non-significant for men (Figure 2), women graduate students (Figure 3), and women professionals without caretaking responsibilities (Figure 4), indicating that productivity is not affected by spillover for these groups.

Job Satisfaction

There were no statistical differences in mean scores of job satisfaction on any of the group comparisons (Table 2). On average, regardless of group, respondents were satisfied with their jobs.

Across all model comparisons (Figures 2-4), the positive relationship between workplace climate and job satisfaction was stronger than the positive relationship between work-life satisfaction and job satisfaction. Moreover, there were no statistically significant differences in the relationships between workplace climate and job satisfaction for any group comparison.

However, there was a statistically significant difference ($z= 2.11$, $p<0.05$) in the relationship between work-life satisfaction and job satisfaction for the child caretaking comparison (Figure 4). We found a moderate positive relationship for women with caretaking responsibilities, but a non-significant and near-zero relationship for women without caretaking responsibilities. Among all groups, women with caretaking responsibilities showed the weakest relationship between workplace climate and job satisfaction (0.67), and the strongest relationship (0.41) between work-life satisfaction and job satisfaction. Nonetheless, these relationships were still consistent with the overall trend that workplace climate had a stronger influence (at least descriptively) on job satisfaction than did work-life satisfaction.

Workplace Climate

Workplace climate was a second-order latent variable, meaning that it is derived from other latent variables. In this case, workplace climate was derived from interaction and influence, reflecting different aspects of workplace climate. For the gender comparison, there was a statistical difference in the mean score of interaction, where women were less satisfied with the level of interaction in their workplace than men (Table 2).

There were also statistical differences in the mean scores of influence for two of the group comparisons. Men were more satisfied with their level of influence in the workplace than were women, and women professionals were more satisfied with their level of influence in the workplace than were women graduate students. The caretaking responsibility comparison showed no difference.

For all groups, interaction and influence had similarly strong relationships to overall workplace climate (Figures 2-4). Measurement invariance testing showed no statically significant differences in the effect of interaction and influence to overall workplace climate within any group comparison, indicating that this construct was measured similarly within each group comparison.

Work-life Satisfaction

On average, men were more satisfied with their work-life balance than were women (Table 2). There were no statistical differences in satisfaction with work-life balance for any other group comparison. We found negative relationships,

moderate to minimal in magnitude, between personal life spillover and work-life satisfaction, and between working long hours and work-life satisfaction

(Figures 2-4). Across all models, workplace expectations of long hours had a stronger negative effect on work-life satisfaction than did personal life spillover. For men (Figure 2), women graduate students (Figure 3), and women without caretaking responsibilities (Figure 4), the relationships between personal life spillover and work-life satisfaction were not statistically significant, indicating that, for these groups, work-life satisfaction is not determined by personal life spillover. Women with caretaking responsibilities reported the highest levels of personal life spillover, and personal life spillover had the strongest effect on work-life satisfaction for this group (Figure 4).

Across all models, workplace climate had a minimal to moderate positive effect on work-life satisfaction. Generally, the more positively an individual's perceptions of their workplace climate, the more satisfied they were with their work-life balance.

DISCUSSION

First we review and interpret findings for each comparison group, then discuss the findings as a whole.

Differences by Gender

We detected several statistical differences in mean scores on scale items based on gender (Table 2). There were no statistically significant differences between women and men in levels of job satisfaction, personal life spillover, and expectation to work long hours. But women reported being less productive and less satisfied with work/life balance, and they viewed their workplace climate less favorably than men, in terms of both interaction and influence.

However, there were no statistically significant differences in the relationships between model variables based on gender (Figure 2). Thus, while women have different perceptions of work-life balance and workplace climates, the effects of these variables on job satisfaction are the same for women as for men. That is, positive and stimulating collegial interactions with colleagues and inclusion in important workplace discussions are crucial for the job satisfaction of both men and women.

Differences by Career Stage

Women graduate students reported being less productive and having less influence in their workplace than did female professionals, but they also reported less personal life spillover (Table 2). For these groups, we also found a statistically significant difference (z= -2.56, p<0.05) in the relationship between workplace climate and work-life satisfaction (Figure 3). For women graduate students, workplace climate was strongly related to work-life satisfaction, while this relationship was much weaker for women professionals.

These results make sense if women graduate students spend a lot of time at the lab or at field sites but perceive this situation to be both normal and temporary, and a means to an end they desire, completing a graduate degree. Their satisfaction with

this situation is shaped by these expectations and mitigated by interactions with research group members with whom they may also interact socially outside work time. For established women professionals, however, interactions with co-workers may be more distinct from their social life and thus spillover between work and personal life is more important in shaping work-life satisfaction and in turn influencing overall job satisfaction and productivity.

Differences by Child Caretaking Responsibility

Women with child caretaking responsibilities reported less productivity and higher levels of personal life spillover than professionals without caretaking responsibilities (Table 2). Moreover, the relationship between work-life satisfaction and job satisfaction differed statistically (z= 2.11, p<0.05) based on child caretaking responsibilities (Figure 4). There was a strong positive relationship between work-life satisfaction and job satisfaction for women with child caretaking responsibilities, while this relationship was weak and not statistically significant for women who did not have child caretaking responsibilities.

It is not surprising that women with children at home reported the highest levels of personal life spillover among all groups, and that this in turn influenced work-life satisfaction to a greater degree than for any other group. Child caretaking responsibilities increase personal life spillover and overall work-life conflict, which leads to lower job satisfaction and productivity. For women without children at home, work-life satisfaction is affected less by competing demands among responsibilities and more by net negative effects of long hours that can interfere with personal activities.

Findings across Analyses

When results are compared across all analyses, a key finding is the relative stability of influences on job satisfaction. For all groups, workplace climate had a larger effect on job satisfaction than work-life satisfaction. These findings are consistent with previous work that has demonstrated the strong effect of workplace climate on job satisfaction (August & Waltman, 2004; Bilimoria, et al., 2006; Callister, 2006; Carr et al., 2003; Gardner, 2012; Litzler, Lange, & Brainard, 2005; Parker et al., 2003; Saddler & Creamer, 2007; Shollen et al., 2009). Moreover, the consistent positive linkages between job satisfaction and productivity show that higher satisfaction does lead to higher productivity, perhaps by enhancing career agency as has been suggested for academics (Campbell & O'Meara, 2014).

Workplace climate was also positively related to work-life satisfaction, indicating that good conditions within the workplace can positively influence work-life satisfaction, which is consistent with prior research (Guest, 2002; Amelink & Creamer, 2007).

The group comparisons also provide evidence about how these influences may change as a result of increased professional and personal responsibilities. For example, in the gender group comparison, we found a minimal positive relationship between work-life satisfaction and job satisfaction for all women. However, after accounting for differences by career stage, work-life satisfaction had no relationship

to job satisfaction for graduate students, but a positive relationship for women professionals. Furthermore, disaggregating women professionals by caretaking responsibilities showed that work-life balance was strongly related to job satisfaction for women with caretaking responsibilities, but not related to job satisfaction for women without caretaking responsibilities. This analysis shows that the relationship between work-life balance and job satisfaction changes dramatically depending on career advancement and family formation.

The lack of differences in the relationships analyzed in our model based on gender comparisons is consistent with prior work. Previous research has shown that gender (when controlling for other variables such as workplace climate) does not influence variables included in this model such as job satisfaction (Callister, 2006).

Limitations of the Study

Most of the limitations arise from the nature of our convenience sample, which was derived from an evaluation carried out for the Earth Science Women's Network. This study included mainly women who are currently employed or pursuing advanced degrees, and does not reflect the perceptions of women who have opted out of geoscience careers. Thus these results provide insight into factors that may affect women's decisions to stay or leave science and how these vary at different stages of their careers and personal lives, but do not explain whether or how these factors affect the decisions of women to opt out of geoscience career paths. The sample of men is comparable to the sample of women but modest in size, and we cannot address whether men's perceptions also vary as their professional and personal responsibilities change.

The sample is limited to geoscientists, 90% of whom had a graduate degree. Compared with other STEM fields, women's representation among Ph.D. earners in geoscience is "medium-low" at 41%, lower than the biosciences but higher than engineering (NSF, 2013), and varying sharply by geoscience subfield (Holmes & O'Connell, 2005; Wilson, 2013). Studies of national samples reveal similar issues of representation and structural and attitudinal barriers for women geoscientists as for women in other STEM fields (Avallone, Hallar, Thiry & Edwards, 2013; Gonzales, 2010; Holmes, O'Connell, Frey & Ongley, 2008), although field work has been proposed as a distinctive disciplinary feature that may increase work-life conflict for early-career geoscientists (Bell & Kastens, 2004). While we have no *a priori* reason to believe that the results would differ significantly for similarly educated scientists in other fields, that question is not addressed by this study.

Moreover, the sample is dominated by academic scientists and may not adequately reflect the expectations or constraints of women scientists in other lines of work. For example, academics typically have high work demands but also high flexibility; different influences might be reported by women technicians who have fixed work hours, but who may also have more work-life supports in corporate settings. Academics also have high expectations for autonomy and equity of influence in the workplace (Austin, 1990).

The sample is dominated by early-career women; over 80% were 40 years of age or less. Thus the results primarily reflect issues for early-career women and cannot detect changes in these relationships for older women who are well established in their careers. Within the sample of child caregivers, the number of women who had preschool children was double the number with school-age children. This study does not reflect changes in women's work-life situation as children grow nor after they leave home. For example, parents of young children may still be developing their strategies for managing work-life conflict, while parents of older children are working within the externally imposed constraints of school and out-of-school activities.

Lastly, most variables were ordered categorical variables, but were analyzed using maximum likelihood (ML) estimation, which is more commonly used with continuous level variables. However, ML can be an acceptable choice for four-category data and is preferred when the sample size is small (Rhemtulla, Brosseau-Liard & Savalei, 2012). With this choice, the factor loadings are most likely underestimated, meaning that the "true" relationships may be stronger than what we have reported.

IMPLICATIONS

The strong effect of workplace climate on job satisfaction and in turn on productivity is encouraging because it implies that, despite variation among individuals in what drives satisfaction with their work-life balance, organizations can positively influence job satisfaction and productivity by fostering positive workplace climates for all (Britton et al., 2012). Some programs may benefit all employees, for example, efforts to develop effective unit leaders and foster transparent and inclusive decision-making, strengthen communication, enhance civility, and build respect. Because of the positive linkage between workplace climate and work-life satisfaction, other programs may differentially benefit certain groups of women.

Indeed, the results highlight that women are not a homogeneous group. Discussion of women's representation in STEM professions must acknowledge that, while caring for children is one influence on some women's experience that may affect their progress and perseverance in STEM careers, biology is by no means the sole explanation of women's persistent underrepresentation (Ceci & Williams, 2011). At the same time, the results show that work-life satisfaction varies depending on both personal and professional circumstances. For professional women who care for children, work-life satisfaction is a strong additional factor shaping their overall job satisfaction and productivity. The absence of organizational work-life initiatives that help women parents handle these conflicts can be a powerful negative influence which may tip the scales for women as they make decisions about whether to continue or leave a science career. Conversely, effective use of appropriate work-life accommodations can improve work-life satisfaction and limit the importance of these factors in shaping women's choices; a good workplace climate can mean that women stay in the job despite their current work-life challenges. Moreover, because of the positive linkage between workplace climate and work-life satisfaction, aspects of workplace climate that directly relate to

work/life issues may be significant. Examples may include unit leaders' acknowledgment of work-life conflict and use of strategies to avoid it (e.g. scheduling meetings to accommodate school schedules), leaders' awareness of policies and programs that help in managing or minimizing that conflict (e.g. parental leave), and colleagues' family-friendly attitudes.

In sum, previous work (Mason & Goulden, 2002) posed the question, "Do babies matter?". Our work shows that clearly they do, for some—but so do the attitudes and actions of leaders and colleagues in a scientific workplace, the 'labmates' of our title. In acknowledging the relative strengths of these multiple and interrelated influences, we avoid essentializing women as child-bearers and highlight the positive effects of good workplace climate on job satisfaction for all scientific workers.

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