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Work and family conflict in academic science: Patterns and predictors among women and men in research universities

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Abstract

This article addresses work–family conflict as reported among women and men academic scientists in data systematically collected across fields of study in nine US research universities. Arguing that academic science is a particularly revealing case for studying work–family conflict, the article addresses: (1) the bi-directional conflict of work with family, and family with work, reported among the scientists; (2) the ways that higher, compared with lower, conflict, is predicted by key features of family, academic rank, and departments/institutions; and (3) patterns and predictors of work–family conflict that vary, as well as converge, by gender. Results point to notable differences, and commonalties, by gender, in factors affecting interference in both directions of work–family conflict reported by scientists. These findings have implications for understandings of how marriage and children, senior compared with junior academic rank, and departmental climates shape work–family conflict among women and men in US academic science.

Keywords

academia, faculty, family, gender, science, universities, work

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Work and family are considered the two most central domains of adult life (Blair-Loy, 2003; Jacobs and Gerson, 2004; Kanter, 2006; Moen, 1992). Work and family are also 'greedy' institutions. Both of these require time and energy, making expandable demands for loyalty that often cut people off from investments elsewhere (Coser, 1974). As such, work and family are institutions that can interfere with each other, so that the time and specific behaviors required for the one make it difficult to fulfill responsibilities for the other (Byron, 2005; Greenhaus and Beutell, 1985). The result is that responsibilities to one's work often conflict with responsibilities to family, and vice versa.

The conflict of work and family can be understood in terms of Durkheim's (1933 [1893]) theory positing that when the work-related division of labor becomes extensive, it carries risks of fragmenting institutions and creating conflicts for individuals. Contemporary social theory also emphasizes that work and family not only interact but also vie with each other, impinging on people's behavior in different and conflicting ways (Dubin, 1976). In recent decades, the ever-growing conflict between work and family is caused, in part, by changing demographics of the workplace, with women working outside as well as inside the home (Frone, 2003; Frone et al., 1992a). These changes reflect a decline in the prevalence of 'separate spheres' of family involvement for women and outside work for men that continued from the early 19th through mid 20th century in the USA as well as many other industrialized nations (Moen, 1992; Moen and Roehling, 2005).

This article focuses upon work and family conflict among women and men scientists in US research universities. The objectives are to address: (1) the bi-directional conflict of work with family, and family with work; (2) the ways in which higher, compared with lower, conflict is predicted by key features of family, senior compared with junior academic rank, and departments/institutions; and (3) the ways that the patterns vary (as well as converge) by gender. This study's method employs survey analysis, based on data collected from the population of tenured and tenure-track women faculty (with sampling in two fields) and a stratified random, probability sample of men, in computer science, engineering, and six fields of sciences within nine research universities with high national rankings, especially in science/engineering. This systematic sampling is a positive and unusual feature of the study. However, the findings do not necessarily generalize to scientists in non-research universities.

We measure work–family conflict with the level of interference that these scientists report in the survey. Most studies, including the US National Survey of Midlife Development and the US National Comorbidity Survey, also address work–family conflict through employees' reports of the extent to which responsibilities and expectations in one sphere (work) interfere with those in another sphere (family or other non-work areas) (Bellavia and Frone, 2005; Schieman et al., 2009). Nonetheless, we should emphasize that our study of work–family conflict examines reports (that is, perceptions) of interference. We did not collect data on measures such as hours devoted to various activities.[1]

Early research on work–family conflict investigated either the impacts of family pressures on work *or* work pressures on family (Greenhaus and Beutell, 1985), giving more attention to the first, compared with the second, type of conflict (Frone, 2003). Later research emphasized both directions of work–family conflict, and examined how the impact of family on work, compared with that of work on family, may have different patterns in the antecedents (Anderson et al., 2002; Byron, 2005; Frone, 2003; Frone et al.,

1992a, 1997; Kelloway et al., 1999). Consequently, it is important to differentiate between the two conflicts, because empirical studies indicate that the two are distinct (though related) constructs (Bellavia and Frone, 2005; Frone et al., 1992a,b; Grzywacz et al., 2002; Netemeyer et al., 1996).

With the exception of a recent article on work–family conflict among scientists and engineers in industrial research and development (Post et al., 2009), few (if any) studies have addressed work–family conflict among scientists using systematic sampling across fields and institutions.[2] The scarcity of such research is surprising, given that science is a revealing case for three reasons.

First, scientific (including engineering) work entails high expectations and sets conditions for potential conflict with non-work domains. The normative expectations in science (and in academia) are that the ideal scientist gives priority to work, has few outside interests or responsibilities, and pursues research single-mindedly (Bailyn, 2003: 139; Ward and Wolf-Wendel, 2004: 237).

Second, for professionals in scientific fields, the work role is highly salient to personal identity. From as early as the beginning of the 20th century, science has been idealized as a 'vocation'. Max Weber (1946 [1919]: 137) characterized science as a 'passion' and 'calling' in which only those who are solely devoted to their work may be said to have 'personality'. Studies conducted over time point to strong identification with work among scientists and engineers, especially among those with doctoral degrees who are employed in research universities (Bailyn and Schein, 1976; Faulkner, 2007; Hall and Lawler, 1970; Lawler and Hall, 1970; McKelvey and Sekaran, 1977; Sonnert and Holton, 1995a,b).

The identification and involvement with work arises early in life among scientists. Those who persist through graduate education often set their sights on a research career during adolescence (Fox and Stephan, 2001). Their involvement in scientific careers progressively shapes their expressions of self and infuses their sense of their personal worth with professional achievements (McKelvey and Sekaran, 1977; Sharone, 2004). Those with such involvement in scientific research are especially responsive to demands of their work settings, because professional success and rewards are so important to them (Frone, 2003; Greenhaus and Beutell, 1985; McKelvey and Sekaran, 1977). Thus, science qualifies as an institution in which the participants have a high level of 'work devotion' (Blair-Loy, 2003, 2004), which claims time and attention, shapes aspirations and desires, and stands in tension with other commitments, including family.

Third, the rewards and standards of evaluation in academic science can heighten the intensity of the work and the striving for achievement. A culture of excellence in academic science sets expectations for long hours of work and sustained performance, especially for those located in high-ranking research departments (Hermanowicz, 2003, 2009). At the same time, the evaluative standards for scientific performance have been characterized as both 'absolute and subjective' (Fox, 1991: 191). This means that the evaluative criteria can be vague; the process of appraisal, inferential; and decisions for allocations of resources and rewards, judgmental (Fox, 1991; Long and Fox, 1995).

Under such conditions, anxiety about professional status may be amplified, fueling a striving to excel against sometimes ineffable standards. Although dissatisfaction with workload increases with the number of hours worked, long hours in work, specifically 60 or more hours per week, are associated with productivity in research, and that is a valued

outcome (Jacobs and Winslow, 2004). When these standards for striving and excelling operate, or are idealized, work claims precedence among scientists, setting the stage for conflict with family.

Some studies, based on national probability samples of the general population (Frone, 2000) and on regional probability samples (Frone et al., 1992a), find that women and men have similar levels of family-to-work, and work-to-family, conflict. Other studies find higher levels of work–family conflict among women (Boulis and Jacobs, 2008; Jacobs and Gerson, 2004). We expected that the levels of conflict would vary by gender among the academic scientists in this study and that women's work–family conflict would be higher than men's. This is because a range of research demonstrates that gender influences how people integrate work with personal roles, and the extent to which they are able (and/or willing) to maintain boundaries between work and family (Boulis and Jacobs, 2008; Colbeck, 2006; Gutek et al., 1991; Jacobs and Gerson, 2004; Jacobs and Winslow, 2004; Moen, 1992; Moen and Roehling, 2005). The result is that even when women have high-level professional careers, they spend more time in family-related tasks and responsibilities than do men (Boulis and Jacobs, 2008) and can experience more work–family conflict.[3]

As indicated, the predictors of work–family conflict analyzed in this study are key characteristics of (1) family, (2) academic rank (senior compared with junior), and (3) department and university. We expect that family characteristics – marriage, presence of children, occupation of spouse, contribution to family income, and reported effects of childcare options – will influence levels of work–family conflict in the following ways.

We expect that marriage and the presence of children, especially children at particular ages, are associated with family-to-work conflict, and that the effects are stronger for women than for men. Marriage and pre-school or school-aged children create demands for investment in home/household, and the normative demands for these investments have been higher (and/or more salient) for women (Boulis and Jacobs, 2008). In addition, women faculty members (like other women) experience physical and psychological demands of pregnancy and childbirth (Grant et al., 2000; Wolf-Wendel and Ward, 2006: 489). Women faculty members may also experience the care of children as 'personal problems', in the words of faculty members interviewed in one study as 'my problem' or 'my conflict', rather than as issues that are broadly and socially structured (Gatta and Roos, 2004: 130). Such experiences may, in turn, heighten their work–family conflict.

It is not just marriage, but the type of marriage, that may relate to work–family conflict. Being married *and* being married to another professor or to a scientist/engineer outside of academia may reduce the probability of work–family conflict, insofar as this type of marriage is a relatively close match to the occupation of an academic scientist. Such a match in spousal occupation creates potential synchrony, or shared understanding, of both work and family demands (Creamer, 2001; Fox, 2005). Further, earner status in the household, specifically the status as primary contributor to household income, can affect work–family conflict. This is because the primary income contributor to the household may be under economic pressure to perform in the workplace and such pressure may be at odds with other family investments (beyond the economic) (MacDermid and Harvey, 2006).

Consistent with research on the effects of 'resources and policies' on work–family conflict (Hecht, 2001; MacDermid and Harvey, 2006), positive childcare options are a resource that may be associated with lower (rather than higher) probability of

work–family conflict. This effect may be stronger among women because of their greater responsibilities in the home (Boulis and Jacobs, 2008; Jacobs and Gerson, 2004).

Academic rank is a positional resource, with junior rank associated with less autonomy and less job security than senior rank. Thus, being an assistant, rather than associate/full professor, may increase the probability of work–family conflict reported among both men and women.

Work–family conflict also needs to be considered in relation to the characteristics of the departments and universities in which academic scientists are employed, such as the field, clarity of evaluation in the department, departmental climate, and type of university (public or private). Studies of scientists indicate that such characteristics are important because, unlike faculty members of non-science units, science faculty work onsite and their performance is tied to organizational work groups, work practices, and work climates (Fox and Mohapatra, 2007). Organizational practices can shape responses to work–family conflict by 'normalizing' expectations about attending to family responsibilities (Amelick and Creamer, 2007). Thus, clarity of evaluation, for example, can contribute to the perception that reward structures are fair and based on performance, rather than on extraneous (non-merit-based) factors. In turn, clarity of evaluation can reduce concerns that workplace penalties exist for simply having children, apart from actual performance in work (Amelick and Creamer, 2007: 330). Departmental climates, along dimensions of fairness, helpfulness, and inclusion, for example, can also affect levels of work–family conflict that academic scientists experience. This is because departmental climate reflects features of the informal workplace, linked to the probability of work–family conflict (Anderson et al., 2002). The field (represented by computer science, sciences, engineering departments) is relevant as a control for the potential effects of the type of scientific department on work–family conflict. Finally, the type of university (private/public) is germane to the extent that private universities have more latitude in developing policies of parental leave, dual-career hiring plans, and life transitions, because they are less constrained by state policies on such matters (Riskin et al., 2007).

Methods

Data

The data reported here come from mail surveys conducted among tenured and tenure-track faculty in fields of computer science, engineering (across engineering fields), and six fields of sciences (biology/life sciences, chemistry, earth/atmospheric, mathematics, psychology, and physics). The faculty members are in nine research universities, including one baseline university surveyed in 2002/03 and eight 'peer institutions' surveyed in 2003/04. The first institution designated the eight research institutions as 'peers' in prestige and national standing. Thus, each of the institutions in the study has high national ranking, especially within scientific and technological fields. At the time of the survey, these institutions were within the Research I and the Doctoral-Research Extensive categories of the Carnegie classifications. They do not represent the entire universe of US institutions. Rather, they represent institutions with doctoral granting departments, strong standing in science/engineering fields, and high levels of federally awarded research grants. This is an important grouping

for a study of science and engineering, because of the impact of these types of institutions for the training of doctoral students and the conduct and advancement of scientific research.

In this study, we specified the population of male and female tenured and tenured track faculty, by field (represented by department), in each of the nine institutions. We accomplished this by obtaining the complete set of faculty rosters for the first institution, and by canvassing completely the websites of the other eight in computer science, engineering, and the six fields of science. In the first institution, the group surveyed is the full population of women (n=68) and a stratified random sample of men, by field (n=148). In the eight other institutions, the group surveyed is the full population of women, except for sampling in the life sciences and psychology (n=437), and a stratified random sample of men by field (n=528). Thus, this study is distinguished by its inclusion of the complete population of women, except in the case of two fields sampled in eight of the institutions, and by a stratified random sample of men from known and specified populations.

Of the 1154 questionnaires sent in 2002–2004, 25 went to faculty members who were ineligible because they had left the department, retired, or died. The number of respondents to the surveys was 765, with an overall response rate of 66.2% (removing ineligibles from the base). The response rate of faculty in engineering (67.4%) was slightly higher than those in computer science (64.5%) and sciences (65.5%). Women's response rate (67.8%) was slightly higher than men's (65.2%).

Dependent variables. We assess *work–family conflict* with responses to two questions: the extent to which the respondents report that: (1) family and household responsibilities interfere with work; and (2) work responsibilities interfere with family and household. The response categories are a four-point scale of: 'not at all', 'very little', 'somewhat', and 'a great deal'. The parallel construction of family-to-work and work-to-family conflict makes it possible to compare responses on the two dimensions.

For the analyses described below, we code the types of work–family conflict as two dichotomous variables of 'somewhat' or 'a great deal' compared with 'very little' or 'no' conflict. We use these two categories because, conceptually, the interest is in conflict that is somewhat/great compared with low/null; and prior research has addressed conflict at these levels, so that we may consider our results in light of those findings.[4]

Independent variables. We assess *family characteristics* through questions about marital status, spousal occupation, contribution to household income, the presence of children in the household, ages of children, and reported effects of childcare options.

We code *marriage* as being in a first or subsequent marriage, compared with the other categories (never married, living with a partner but not married, divorced or separated, or widowed). Spousal occupation is categorized as having a spouse, and, for those who have a spouse, as having or not having a spouse who is a college/university professor or one who is employed in another position in scientific/engineering fields. Thus, the contrast is between being married to a faculty member or a scientist/engineer in another position, versus not being married to an academic or to a scientist/engineer in another position. The interest, then, is in marriage to someone who is not a spouse with an occupation that is relatively close to or synchronized with that of an academic scientist (Fox, 2005).

We code contribution to household income as primary contributor (=1), compared with sole or equal (=0) or secondary contributor (= –1). This takes into account that 'sole earners'

include those who are the only members of their household, while 'primary earners' are members of dual-member households, with implications for work–family conflict.

We code the presence of children as two separate variables: the presence or absence of children under the age of 6 years, and presence or absence of children aged 6–18 years. We code childcare options as the reported positive effect (=1), compared with negative effect (= –1) or of no effect (=0), of childcare options on work.

We assess *rank* through a question on current academic rank. Rank appears as a dummy variable with full/associate professor = 1, and assistant professor = 0. The variable takes this form of senior compared with junior rank because: (1) the full/associate professor levels are the traditional senior ranks, while assistant professors are the junior ranks; (2) the two senior ranks are most frequently tenured positions; and (3) previous analyses of women and men in science have compared faculty in such senior and junior ranks, so that our findings can be compared with these. It is also the case that in other surveys, the men are more likely to be in senior ranks, particularly in the full professor rank. Among the respondents in this study, 66% of the men, compared with 39% of the women, are full professors; 20% of the men and 26% of the women are associate professors; and 14% of the men and 36% of the women are assistant professors.

We assess *departmental/university characteristics* through field, type of institution, reported clarity of evaluation, and reported departmental climate. We code field as being in a science and engineering department (where computer science is the comparison). Type of institution appears as a dummy variable with private institution = 1, public institution = 0. Clarity of evaluation appears as a dummy variable with responses of 'very' or 'somewhat' clear perceptions of the clarity of evaluation for salary and promotion in home department = 1, and 'slightly' or 'not at all clear' = 0. Department climate refers to respondents' perceptions of goals, values, and practices within their department – in brief, 'the way things are done around here' (Reichers and Schneider, 1990). For most people familiar with higher education, departmental climate has 'face validity', and is regarded as a reasonable way to conceptualize the atmosphere of a unit (Peterson and Spencer, 1990).

In this study, we measure departmental climate with questionnaire items that asked respondents to rank their department along eight scaled (five-point scale), bipolar dimensions of: formal–informal, boring–exciting, unhelpful–helpful, uncreative–creative, unfair–fair, noncompetitive–competitive, stressful–unstressful, and noninclusive–inclusive. A factor analysis identified three constructs, representing relationships among these eight dimensions. The first construct represents a 'collegial departmental environment', with items that characterize it as helpful, fair, and inclusive. The second construct represents a 'stimulating departmental climate', with items characterizing it as informal, exciting, and creative. The third represents an 'uncompetitive/unstressful departmental climate', with items characterizing it as noncompetitive and unstressful. The correlations among these items and the factor loadings appear in Table 1.

On the bases of the underlying items in the constructs, we created unweighted scales to represent the mean values of the responses to the corresponding variables.[5] Reliability tests of the scales yielded Cronbach's alphas of .765 for the collegial climate scale, .704 for the stimulating climate scale, and .695 for the uncompetitive/unstressful climate scale. These reliabilities are sufficiently high to justify inclusion of the scales in the regression models.

Table 1. Dimensions of departmental climate: correlation matrix and factor loadings for underlying constructs

Variable								
School character: formal–informal	1.000							
School character: boring–exciting	0.312	1.000						
School character: unhelpful–helpful	0.267	0.554	1.000					
School character: uncreative–creative	0.255	0.745	0.615	1.000				
School character: unfair–fair	0.107	0.311	0.449	0.338	1.000			
School character: competitive–noncompetitive	0.081	−0.107	0.008	−0.132	−0.092	1.000		
School character: stressful–unstressful	0.157	0.016	0.206	0.007	0.062	0.529	1.000	
School character: noninclusive–inclusive	0.170	0.412	0.566	0.421	0.543	0.047	0.178	1.000
Factor loadings (varimax)								
Collegial	−0.119	0.397	0.657	0.461	0.835	−0.057	0.148	0.813
Stimulating	0.751	0.759	0.513	0.714	0.017	−0.040	0.068	0.192
Uncompetitive/unstressful	0.226	−0.145	0.100	−0.173	−0.048	0.863	0.855	0.135

Method of analysis

In order to predict work–family conflict, we present logistic regression in two models – interference of family with work and work with family – separately for men and for women scientists. The logistic regression models express the relationship between the dependent variable – somewhat or great, compared with very little or no conflict – and the independent variables of family characteristics, senior/junior rank, and departmental/institutional characteristics. In the analyses, we separate the models by gender, because of our interest in comparing how the independent variables relate to work–family conflict for men and for women.

The logistic regression models present the log odds or predictive value that an independent variable has for the dichotomous dependent variable. Thus, we interpret the coefficient from a logistic regression equation as the change in log odds of a response per unit of change in the predictor variable. The models do not posit a particular causal ordering among the independent variables. Rather, the focus is upon the strength and form of the relationships between work–family conflict and the independent variables of interest, as they operate for men and for women scientists.

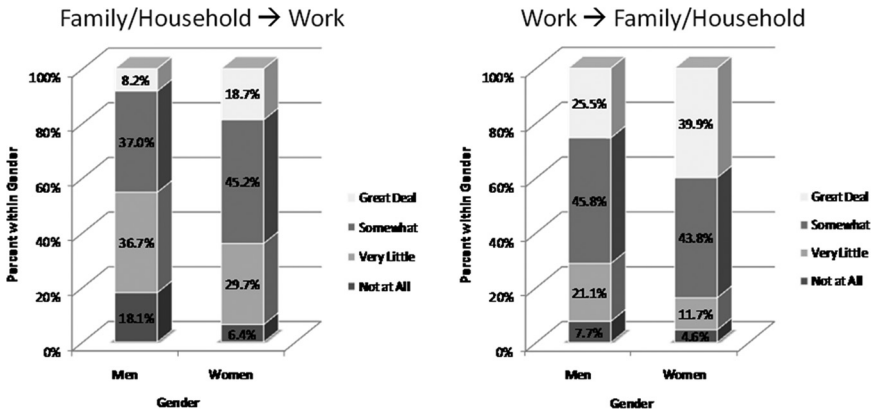

Figure 1. Distribution of levels of types of interference by gender

Findings

Descriptive profile of work–family interference, by gender

Conflict between work and family goes in both directions for these academic scientists: family/household interferes with work, and work interferes with family/household. However, respondents report more interference of work with their family/household than the other way around (Figure 1). Specifically, 76.7% of the scientists report that work 'somewhat' or 'greatly' interferes with family, while 53.4% report that family 'somewhat' or 'greatly' interferes with work. Women and men scientists both report work–family conflict, and so this is not simply a 'woman's problem'.

However, a significant gender difference exists for both types of conflict, and the gender difference is somewhat larger for interference of family with work (than the other way around). Specifically, for women the mean level of conflict of family/household with work is 2.76, whereas for men the mean level is 2.35 (on a four-point scale) (Figure 2). For the other direction, the mean level of conflict of work with family/household for women is 3.19, whereas for men it is 2.89 (Figure 2). (For a table of descriptive statistics for family characteristics, see Appendix).

Models of family/household interference with work

The combined effects of family characteristics, rank, and departmental/institutional variables on the two types of work–family conflict appear in logistic models, separately for men and for women scientists. Model 1 (Table 2) presents the coefficients (log odds) for each independent variable on the dichotomous dependent variable of 'great' or 'moderate' (compared with 'slight' or 'no') conflict of family/household upon work – when other independent variables are controlled. For each independent variable, the probability change in the predicted outcome appears in parentheses in the table (Table 2). The findings from the models concentrate on the significant effects, while noting some interesting, nonsignificant effects.

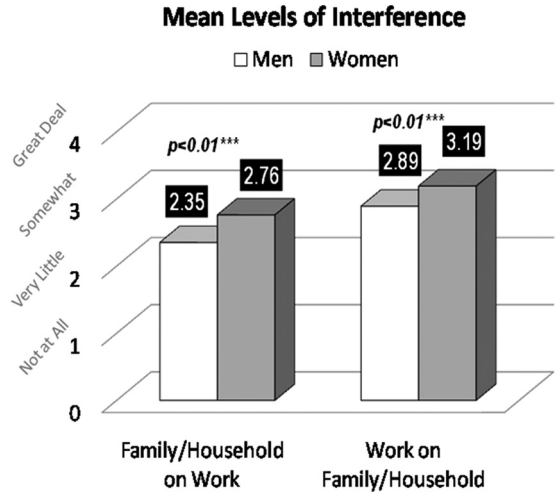

Figure 2. Mean levels of interference by gender

Men. In Model 1 for men in the study, we find that the following family characteristics are significant predictors of conflict of family upon work: being married (log odds .76, p<.05); having children under age 6 years (log odds 1.0, p<.01); and having children age 6–18 years (log odds 1.14, p<.01). In addition, positive childcare options predict less conflict (log odds = –0.80, p<.05). The other family characteristics (contribution to household income and marriage to a professor or a scientist/engineer in another position) have no effects upon family interfering with work.

For men, senior academic rank (being a full/or associate, rather than assistant, professor) does not affect the likelihood that family conflicts with work. Of the departmental/institutional variables, one type of departmental climate explains variation: being in a department with an 'uncompetitive/unstressful climate'. As the departmental climate becomes increasingly 'uncompetitive/unstressful', the probability of interference decreases (log odds –0.32, p<.05). The other departmental and institutional variables (other climates, field, clarity of departmental evaluation, and public/private type of institution) have no effects on family-to-work conflict among men (Table 2).

Women. For women scientists, the model of family-to-work conflict points to somewhat different patterns (Table 2). The presence of children under the age of 6 years (log odds 1.42, p<.01), and of children age 6–18 years (log odds 1.46, p<.01), significantly increases the probability of family interference with work. However, controlling for all the independent variables, the other family characteristics do not have an effect.

In addition, for family-to-work conflict, senior academic rank operates differently, by gender. Among women scientists, holding a senior academic rank increases the probability of family interfering with work (log odds .53, p<.10), while among men, senior rank has no effect. Of the departmental/institutional characteristics, the variable that approaches significance for women scientists is a 'collegial' departmental climate. As

Table 2. Logistic regression model 1, family/household interference with work, by gender

	Men		Women	
	Coefficient	Prob. change	Coefficient	Prob. change
Family characteristics				
Married	0.76**	(0.177)	0.32	(0.071)
Spouse occupation	0.33	(0.082)	0.01	(0.003)
Primary contributor	−0.07	(–0.017)[a]	−0.16	(–0.035)[a]
Children age <6 years	1.00***	(0.245)	1.42***	(0.262)
Children age 6–18 years	1.14***	(0.278)	1.46***	(0.274)
Childcare availability	−0.803**	(–0.177)[a]	−0.48	(–0.102)[a]
Position				
Rank	−0.08	(0.019)	0.53*	(0.116)
Department/institutional characteristics				
Engineering	−0.51	(–0.126)	−0.02	(–0.005)
Science	−0.18	(–0.045)	0.46	(0.098)
Private institution	0.49*	(0.121)	0.27	(0.056)
Collegial Climate	−0.01	(–0.002)[a]	−0.27*	(–0.057)[a]
Stimulating Climate	−0.06	(–0.015)[a]	−0.23	(–0.049)[a]
Uncompetitive/unstressful Climate	−0.32**	(–0.079)[a]	−0.04	(–0.009)[a]
Clarity of evaluation	−0.26	(–0.064)	−0.30	(–0.061)
N	365		282	
Constant	–1.777		–0.857	
Pseudo R^2 (Nagelkerke)	0.237		0.293	

Significance levels: ***p<0.01, **p<0.05, and *p<0.10.
[a]Probability change ± mean.
Comparison institutional field is computer science.
Dependent variable coding: 'somewhat' or 'great deal' of interference = 1, and 'very little' or 'no' interference = 0.

the perceived climate becomes more 'collegial', the probability of family-to-work conflict decreases (log odds –.27, p<.10). However, in this model, the effect of 'collegial' climate, the strongest of the climate variables for women, is weaker than the climate effect of 'uncompetitive/unstressful' for men, which is the strongest of the climate variables for men. The other departmental/institutional variables have no effects on family-to-work conflict among women (Table 2).

Models of work inference with family/household

Men. Model 2 presents the logistic model of work-to-family conflict – the other direction of interference (Table 3). For men, the same family characteristics predict conflict as in the previous model 1 (Table 2). That is, the presence of children under 6 years old increases the sense of conflict of work with family/household (log odds 1.58, p<.01), as does that of children age 6–18 years (log odds 1.19, p<.01). Positive childcare options decrease the likelihood of this conflict (log odds –1.41, p<.01).

As in the previous model for men, senior academic rank does not affect the likelihood of conflict. Among the departmental/institutional characteristics considered, two variables significantly affect the probability of work-to-family conflict: an 'uncompetitive/unstressful' departmental climate and clarity of departmental evaluation. Thus, as the reported departmental climate becomes more 'competitive and stressful', the probability of work-to-family conflict increases (or conversely, as the departmental climate becomes 'less competitive and stressful', the probability of conflict decreases) (log odds –0.44, p<.01). Further, as clarity of evaluation increases, the probability of this type of conflict decreases (log odds –1.11, p<.05). Scientific field has no effect; nor does being in a private compared with public university

Women. Model 2 also presents the logistic model for work-to-family conflict for women scientists (Table 3), and shows that only one family characteristic predicts this direction of interference: the presence of children age 6–18 years (log odds 1.34, p<.01) .

Again, senior academic rank is a significant predictor of interference for women scientists. However, in this model, the direction of the effect is *opposite* to that in the previous

Table 3. Logistic regression model 2, work interference with family/household, by gender

	Men		Women	
	Coefficient	Prob. Change	Coefficient	Prob. Change
Family characteristics				
Married	0.30	(0.054)	0.55	(0.061)
Spouse occupation	0.45	(0.070)	−0.28	(–0.029)
Primary contributor	−0.02	(–0.003)[a]	0.45	(0.046)[a]
Children age <6 years	1.58***	(0.198)	0.52	(0.049)
Children age 6–18 years	1.19***	(0.184)	1.34***	(0.116)
Childcare availability	−1.41***	(–0.240)[a]	−0.20	(–0.021)[a]
Position				
Rank	0.65	(0.124)	−0.96***	(–0.089)
Department/institutional characteristics				
Engineering	−0.14	(–0.024)	0.86	(0.086)
Science	−0.47	(–0.082)	0.50	(0.050)
Private institution	0.16	(0.026)	0.75*	(0.072)
Collegial Climate	−0.02	(–0.004)[a]	−0.01	(–0.001)[a]
Stimulating Climate	−0.10	(–0.018)[a]	0.02	(0.002)[a]
Uncompetitive/unstressful Climate	−0.44***	(–0.076)[a]	–0.55***	(–0.056)[a]
Clarity of evaluation	−1.11**	(–0.148)	–0.36	(–0.037)
N	365		282	
Constant	0.803		1.078	
Pseudo R^2 (Nagelkerke)	0.260		0.220	

Significance levels: ***p<0.01, **p<0.05, and *p<0.10.

[a]Probability change ± mean.

Comparison institutional field is computer science.

Dependent variable coding: 'somewhat' or 'great deal' of interference = 1, and 'very little' or 'no' interference = 0.

model. In model 2, associate/full professors have significantly lower probability (log odds –0.96, p<.01), and, reciprocally, assistant professors, significantly higher probability of work-to-family conflict.

Of the departmental/institutional characteristics, two are significant predictors of work-to-family conflict for women scientists. Being in a private university increases the probability (log odds 0.75, p<.10) of this type of conflict, while location in a department perceived to have an uncompetitive/unstressful climate significantly decreases that probability (log odds –0.55, p<.01). The other types of departmental and institutional characteristics have no effects.

Discussion and conclusions

What are the implications of these findings for the central research questions of this study? What do these findings reveal about levels of work and family conflict for women and for men scientists?

The academic scientists in this study report both conflict of (1) family on work, and (2) work on family. For men and women in this study, the conflict is higher for work upon family (than the other way around). Work-to-family conflict, on average, is 3.19 for women, and 2.89 for men; and thus, it is moderate for both, but somewhat higher for women (where 3 = 'somewhat' on the four-point scale). Family-to-work conflict is lower, on average, for both, at mean level of 2.76 for women and 2.35 for men (where 2 = 'very little' on the four-point scale) (see Figure 2).

Other surveys, using regional and national probability samples of employees in one or more organizations (Frone, 2003) and samples of other employees (Gutek et al., 1991; Jacobs and Gerson, 2004), also report the higher level of work-to-family conflict – pointing to the importance of distinguishing between the two types (or directions) of conflict. The higher level of interference of work with family likely mirrors broad, national pressures in the US for emphasizing work over other interests (Frone, 2003; Jacobs and Gerson, 2004). Compared with family roles, work roles are tied to people's positions within formal organizations and the system of social stratification in the US (Shieman et al., 2009). Thus, negative sanctions (both at personal and institutional levels) may discourage employees from allowing family to interfere with work. In comparison, fewer negative sanctions discourage one from taking work problems into the home (Kelloway et al., 1999). This pattern may operate especially among academic scientists in high-ranking research universities, a group for whom work is a focused way of life and for whom institutional demands and expectations are high (see Hermanowitz, 2009).

At the same time, gender differences show up in reported levels of work and family conflict in this study. Women report significantly higher interference of both family on work and work on family than men do. However, as specified above, the gender difference is somewhat greater for the first type of conflict. This is consistent with findings reported elsewhere of greater family-to-work conflict among women, even among those with high-level careers (Boulis and Jacobs, 2008).

Next, what are the broader implications of the findings about key characteristics – family, senior compared with junior academic rank, and department and university–that are the focus of this study? How do these characteristics predict work–family conflict for

women compared with men in these research universities? Do we find any surprising results? Noteworthy variations in predictors, by gender, appear in three areas: the effects of (1) marriage, (2) children by ages of children, and (3) senior compared with junior academic rank. These variations are not necessarily obvious, and merit consideration.

First, marriage does not significantly raise or lower the probability of work-to-family interference among either women or men in this study of scientists. However, being married significantly increases the probability of conflict in the other direction – family-to-work – for men, but *not* for women. What might explain this particular pattern?

The pattern possibly relates to the greater likelihood that the men's spouses act as 'social managers' within the family/household (DeVault, 1999; Di Leonardo, 1987). This means that a man who works in the sciences may be more likely to have a spouse who arranges social engagements and activities that are not related to – and may conflict with – the scientific work. The result may be that for men in high-ranking research universities, being married then heightens the probability of reported family-to-work interference.[6] This possibility remains to be tested further.

Second, the presence of children under age 6 years or of school-aged children (age 6–18 years) has similar effects on family-to-work conflict for both women and men in the study. However, in the case of work-to-family conflict, the presence of children under age 6 years significantly increases the probability of such conflict among men, but *not* among women. This latter finding is contrary to other studies on the effects of younger children on work–family conflict (Bellavia and Frone, 2005) and seems counter-intuitive in light of presumed demands that young children present for women. How might we account for this pattern?

Women who have preschool-aged children, and at the same time retain tenured and tenure-track positions in scientific fields,[7] may find ways to adjust their work patterns to reduce impact on their families. This possibility is supported by prior research showing that women scientists with preschool-aged children are highly selective in the way they devote time to research-related activity (Fox, 2005); and that women scientists with young children exercise 'disciplined choices' in management of work (Cole and Zuckerman, 1987). Men who have preschool-aged children and who retain tenure and tenure-track positions in academic science may use less selectivity in the conscious management of their work, so that having young children raises the likelihood that their work will interfere with family. These possibilities are subject to further investigation.

Third, academic rank has a more sensitive and unexpected relation to work–family interference for women as compared to men in this study. Senior (full/associate professor) compared with junior (assistant professor) rank predicts work–family conflict for women, but not men. Further, this effect of rank for women depends upon the type/direction of interference. Holding senior rank *decreases* the likelihood of work-to-family conflict, but *increases* the likelihood of family-to-work conflict for women in the study. This is a surprising result that warrants consideration.

The finding that senior rank increases the likelihood of family-to-work interference is consistent with interview data on how women may handle the challenge of managing family in relationship to work. Interestingly, Stone's (2007) interviews with women report that women 'solidify their family roles' with relatively higher amounts of professional experience. This pattern of increasing family-to-work conflict for women with

senior rank may also reflect the demands of caring for aging parents and other family members (Marks, 1996). The US has an aging population with a growing proportion of persons over age 65 years, and caregiving responsibilities for elders have tended to fall disproportionately upon women (Marks, 1996). Data on elder care, however, are not available in the present study.

The patterns of work–family conflict for senior women in the study may also reflect complex ways in which faculty positions operate, more broadly, among women in academic science. The seemingly anomalous pattern of senior rank predicting higher family-to-work conflict found here is consistent with some other studies, which also suggest that promotion from assistant to associate and/or full professor does not necessarily ease the personal and professional burden on women scientists (Members of the First and Second Committees on Women Faculty in the School of Science, 1999).[8]

In the present study, other patterns among women and men are also notable. The scientific field has no effect on reported levels of work–family interference for either women or men. Consequently, there may be no need for universities to create separate work–family policies for scientists in different scientific fields, even though scientific fields are not necessarily uniform in other ways, such as in work practices.

In addition, for both women and men in the study, marriage to another professor or to a scientist/engineer in another position does not predict either family-to-work or work-to-family conflict, when the other variables are controlled. Marriage to another professor or to a scientist outside academia may involve a relatively 'synchronized' pattern between spousal occupations, which can enhance shared understandings of the nature and demands of scientific work (Fox, 2005). However, this variable does lower the probability of work–family conflict for the scientists in the study.

Further, for both women and men scientists, the uncompetitive/unstressful climate is the strongest *and* most consistent of the departmental climate constructs for predicting work–family conflict. Being in a less competitive/stressful departmental climate decreases the probability of family-to-work conflict for men, and decreases the probability of work-to-family conflict for both men and women. Competition has long been regarded as an endemic and functional feature of scientific communities that contributes to – and reflects – strong research activity (Becher, 1990; Gaston, 1974; Hagstrom, 1974; Stephan, 1996; Zuckerman, 1978). However, such characterizations of competition have been made at the level of research communities, and not at the local level of the department. A perceived lack of competition at the departmental level may be associated with reduced tensions among faculty, which, in turn, may lower the probability of work-to-family conflict, as indicated in this study. The effect of departmental climate on work–family conflict should be explored in continuing study.

Work–family conflict has been associated with job dissatisfaction, burnout, and psychological distress among employees in a range of occupations (Kelloway et al., 1999; Netemeyer et al., 1996). A study of industrial scientists and engineers, in particular, indicates that work-to-family conflict can lead to increased work dissatisfaction and intentions to change the place where these scientists work (Post et al., 2009). Although measures of dissatisfaction, burnout, turnover, and distress were not

available in the present study, our findings suggest that administrative efforts to shape academic, departmental-level climates in order to reduce work–family conflict may improve faculty retention and job satisfaction. This, of course, would need to be pursued with further research.

Other implications for organizational initiatives arise from this study's findings on the effects of the presence of children. As the data indicate, the presence of children in scientists' households tends to increase work–family conflict, although the amount of conflict varies with the age of children, direction of work–family interference, and gender of the faculty member. In the case of family interference with work, children under the age of 6 years and children of school age predict greater interference with work among both women and men; in the case of work interference with family, children in both age groups predict interference for men, and school-aged children predict interference for women. Overall, these findings indicate that work–family conflicts may be reduced by after-school programs and programs during 'break' periods for school-aged children, as well as by pre-school childcare programs.

Previous studies indicate that work–family conflict contributes to attrition among graduate students, postdoctoral scientists, and early career scientists (Long, 1987; National Research Council, 1998; Xie and Shauman, 2003) through experiences of 'overload', 'demands', and 'interference'. If this attrition exists, then only the most persistent researchers prevail in attaining high-level scientific careers, and becoming full-time, employed tenured and tenure-track academic scientists at research universities like the subjects in the present study. The work–family conflict reported here is notable, but it would be greater, potentially, if the study could capture those who leave science at earlier stages because of work–family conflict. Continuing study of the effects of work–family conflict for scientists at the educational and training stages, as well as the career stage, will enhance our understanding of the range and complexity of work–family conflict in the sciences.

Appendix

Table 1. Descriptive statistics for family variables by gender

Family characteristics	Men	Women
Married, first or subsequent marriage (%)	84.9	69.3
Spouse + occupation as college teacher or S/E* (%)	18.6	49.1
Contribution to household income (%)		
Sole or equal contributor	56.7	74.2
Primary contributor	41.6	19.1
Secondary contributor	1.6	6.7
Presence of children age <6 years (%)	16.7	28.3
Presence of children age 6–18 years (%)	34.8	31.4
Childcare (%)		
Reported as positive	3.0	4.9
Reported as negative	13.4	29.3
Reported as no effect	83.6	65.7

*Science/Engineering (S/E).

Notes

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1. Studying reports of work–family conflict is advantageous when a relatively short interval exists between the experience and report of the conflict (Grzywacz et al., 2002).
2. Personal narratives of women scientists (Monosson, 2008), narratives about academia (Bassett, 2005), and studies of single institutions (Stollen et al., 2009) have addressed work–family conflict in science. Practices and policies to better support the integration of work and family life are increasingly prevalent in academic institutions (Bracken et al., 2006).
3. Because women may attach more importance to family than do men, it is also possible that women's perceptions of work–family conflict could be more acute (that is, higher) than men's, even after controlling for time spent one sphere (family) compared with the other (work). No data are available here to address this particular possibility.
4. For women and men combined (on cases complete for independent variables in the analyses), 13% reported that family interfered with work 'not at all', 33.6% 'very little', 40.6% 'somewhat', and 12.8% 'a great deal'. For conflict in the other direction, 6.3% reported that work interfered with family 'not at all', 17% 'very little', 44.9% 'somewhat', and 31.8% 'a great deal'.
5. We use unweighted scales for two reasons. First, factor loadings relating to each construct did not show wide variations among themselves. Second, unweighted factor-based scores emphasize the grouping of variables that load on a particular factor rather than small distinctions among the underlying variables.
6. It is also possible that social management by spouses would *reduce* the domestic responsibilities of the men scientists. This would be expected to lower the probability of family-to-work interference, however.
7. In the sampling design of this study, the academic scientists have tenured or tenure-track appointments in fields of computer science, engineering, or one of the six fields of science considered.
8. This effect of rank on family-to-work conflict may also relate to the small numbers of senior women, especially in fields of engineering, physical sciences, and computing, and the demands for service that they experience, as well as their other responsibilities. The root of these patterns remains to be determined.

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