Running head: WOMEN OF COLOR

Women of Color Faculty in Science Technology Engineering and Mathematics (STEM): Experiences in Academia *

Sylvia Hurtado and Tanya Figueroa
University of California, Los Angeles

American Educational Research Association (AERA)
April 2013
San Francisco, California

This study was made possible by the support of the National Institute of General Medical Sciences, NIH Grant Numbers 1 R01 GMO71968-01 and R01 GMO71968-05 as well as the National Science Foundation, NSF Grant Number 0757076. This independent research and the views expressed here do not indicate endorsement by the sponsors.

Contact: Sylvia Hurtado, 405 Hilgard Ave., 3005 Moore Hall, University of California, Los Angeles, CA 90095-1521; Email: sylvia.hurtado@gmail.com

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

Introduction

It is necessary to examine the experiences of talented women of color in postsecondary learning and work environments in order to inform actionable solutions to improve their rate of success in the academy. While the phenomenon of underrepresentation for women of color in STEM may start during the early school years, it accumulates over time within colleges and universities. For example, although women among African American, Latina/o, and American Indian undergraduates are more likely than men to complete college degrees within six years, those aspiring to major in STEM fields at college entry were significantly less likely than their underrepresented minority (URM) male counterparts to be retained in STEM (Hurtado et al., 2012a). For those women who persist to graduate school and complete a degree, the outlook for a career in academia is replete with challenges. In a paper commissioned for the National Academy of Sciences proceedings, using data from the National Science Foundation, Ginther and Kahn (2012) found that women of color represent only 2.3 percent of the tenured or tenure track faculty and 5.1 percent of non-tenure-track faculty, despite the fact that they make up 12.5 percent of the U.S. population. Moreover, among Ph.D. recipients, women of color have a lower likelihood of reaching the rank of full professor with tenure than their male and white counterparts. This structural underrepresentation affects the climate for diversity on two levels in an institution: It directly affects the behaviors and interactions with others in a campus context, and on a psychological level, it shapes the perceptions that others hold of women of color, as well as their own perceptions of the learning and work environment (Hurtado et al., 2008.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

Macro issues that involve the pipeline do not fully explain why there are so few women of color in the STEM professoriate. A telling example is in academic medicine, where women comprise a small proportion of the faculty despite near parity in the number of female and male students graduating from medical school (AAMC, 2005). Trower (2008) partly attributes the severe underrepresentation of women and ethnic minorities in STEM academia to an unwelcoming institutional and departmental culture. In a survey of over 1,800 STEM faculty members at 56 universities, an individual's "sense of fit" or sense of belonging to their department was the single most important climate factor predicting job satisfaction (Trower, 2008). Another study, using interviews of established women of color in the physical sciences, demonstrated that belonging to a community allowed them to stay abreast of issues within their field and provided important opportunities to network and collaborate with others (Liefshitz et al., 2011). Having supportive and collegial relationships with colleagues and mentors is especially important for women of color in STEM because it helps them build the confidence "needed to succeed and persist, counteracts negative experiences, and sustains endurance in challenging circumstances" (Liefshitz et al., 2011, 14). Focused and comparative difference research may provide information about individual and collective strategies that may be used to overcome challenges and increase the odds of success for greater numbers of women of color.

Previous research suggests that women of color face a "double bind" for having two identities that are especially undervalued in STEM contexts: that of being female *and* a racial minority (Ginther and Kahn, 2012; Liefshitz et al., 2011). Instead of a double disadvantage, some researchers have found that the intersection of both gender

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

and race is reflected in women of color's unique perceptions of the workplace in academia (Aguirre et al., 1993) and that their professional experiences in STEM are qualitatively different than that of men and of white women (Liefshitz et al., 2011). Reay (2007, 607) offers yet another potential hypothesis: "Different aspects of self become more prominent in some contexts than in others." In some situations, one identity is foregrounded and the other muted, whereas in other contexts the reverse may be true. The theoretical and empirical challenge for researchers is to consider both conceptions of difference and structural inequalities.

Research has shown that women and individuals from ethnic minority groups are less satisfied with the academic workplace and have a higher probability of leaving the academy early in their careers compared to their male and white colleagues (Trower and Chait, 2002). However, it is uncertain whether women of color are even more likely than ethnic minority men or white women to leave the academy early in their STEM careers and whether their reasons for leaving coincide with or differ from those reported by the other groups. With the few exceptions noted in this paper, most studies have not disaggregated faculty data to focus specifically on the experiences of women of color.

The purpose of this paper is to explore the experiences of underrepresented women of color in academia. We compare URM women with STEM colleagues in terms of sources of stress, workload demands, and satisfaction. Although there are few sources of quantitative data that have a large enough sample size to make definitive statements about STEM women of color as a group, the national faculty surveys administered triennially by the Cooperative Institutional Research Program (CIRP) at the Higher Education Research Institute (HERI), represent an excellent repository of

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

information that begins to shed light on how URM women are unique from or share similarities with white and Asian women in STEM and their URM male counterparts. Because hundreds of colleges and universities have taken the HERI faculty survey over the years and because raw data and reports are given to all participating institutions to use in their institutional planning and reporting, these data could be useful in gaining a better understanding of URM women's work–life experiences and improving the environments for all underrepresented groups in STEM.

Method

Data Source

HERI employs a stratified institutional sampling scheme for all of its surveys to ensure representation that reflects all nonprofit, postsecondary institutions. Four-year colleges and universities identified as part of the national population are divided into 20 stratification groups based on type (four-year college, university), control (public, private nonsectarian, Roman Catholic, other religious), and selectivity in admissions defined as the median SAT Verbal and Math scores (or ACT composite score) of the first-time first-year students. The methodology for the surveys are described in two reports on nationally normed data by institution type, gender, and rank (Hurtado et al., 2012b; DeAngelo et al., 2009). CIRP invites campuses to participate and provides them with guidelines for survey administration; the survey instrument is administered via the Internet.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

For the analysis of this paper, we utilized data collected from the 2007 and 2010 HERI faculty surveys. In cases in which institutional stratification cells were insufficient for drawing conclusions, we supplemented the sample by identifying additional faculty at those institutions for inclusion and sent them surveys to augment the sample.

Academic department or field of study is typically not considered when soliciting participation in the HERI faculty survey from institutions or in the development of supplemental samples targeted to complete all areas of the sample stratification scheme. However, in 2007 and 2010, HERI sought supplemental STEM faculty samples, targeting institutions that had participated in CIRP administered student surveys as part of a longitudinal study of URM undergraduate student experiences in STEM sponsored by the National Science Foundation and the National Institutes of Health (see Web site http://heri.ucla.edu/nih/). To match student and faculty data from the same institutions, STEM faculty were identified via campus Web sites across all STEM departments that taught undergraduates. Augmentation occurred based on the institutional stratification scheme and also specifically included minority-serving, four-year institutions.

Sample. STEM faculty members were selected from all CIRP participating institutions and included the supplemental sample of STEM respondents in 2010-11. This sample was augmented with STEM respondents to the 2007-08 survey from an additional 98 institutions (non-duplicative) in order to maximize the population of underrepresented women respondents included in the data. This resulted in a total sample of 673 institutions and 11,039 STEM faculty members, 272 of whom were underrepresented women of color. 601 individuals chose not to provide information on

rank and therefore are not included in any of the rank analyses. Approximately 7 percent of survey participants indicated their principal activity was administration, 76.9 percent indicated teaching, 13.9 percent indicated research, 1 percent indicated services to clients and patients, and another 1 percent indicated other or did not provide an answer. An additional 2.8 percent of respondents did not indicate their race or gender on the survey and were excluded from all analyses in the tables that follow.

Limitations. While we cast a large net to increase the probability of capturing STEM faculty, supplemental sampling procedures did not specifically select and identify all underrepresented faculty in STEM. Although administration of the survey is traditionally focused on undergraduate teaching faculty, campuses were encouraged to administer widely to all faculty. Results may be less representative of STEM faculty who are employed primarily in research positions. Despite new survey questions targeting part-time faculty and encouragement to survey part-time faculty in both 2007 and 2010, many institutions did not survey part-time faculty due to the additional cost. Consequently, only 7.2 percent of the sample are part-time faculty.

One specific limitation we have observed over the years is that the most vulnerable populations may not respond to surveys or may neglect to provide identifying information (rank, race/ethnicity, or department). Although the survey addresses issues of climate and work demands, we may be underestimating these issues for individuals who do not want to risk being identified by their own institutions. We typically use weights to represent the national population of men and women faculty for all HERI reports; however, we did not weight the responses in this sample because the exact number of faculty working in STEM fields and their corresponding demographic

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

information were not available in the Integrated Postsecondary Education Data System (IPEDS). In the future, NSF data could be instrumental in helping to weight responses obtained using HERI surveys. Finally, small sample sizes prevent further disaggregation by underrepresented groups (Latina/os, African Americans, and Native Americans). Even when collapsed together, the number of individuals in the URM categories is rather small, making it less likely that statistical comparisons will be significant between the URM groups and others. We have only emphasized those results that are statistically significant between URM women and other groups.

Lack of Power and Authority in Academia

Table 1 shows the respondents' academic rank by race and gender in the sample. Women of color represent only 2.5 percent of the sample of respondents. They are least likely to be represented among full professors in the sample, and more likely to be represented at the lowest ranks, which have the least power and authority in academic decision-making.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

Table 1.
Proportion of STEM Faculty in Sample by Race/Ethnicity, Gender, and Academic Rank (n=11,039)

			Academic Rank				
	n	% of sample	Professor	Associate	Assistant	Lecturer/ Instructor	No Rank Data
URM Women	272	2.5	16.2	24.6	31.3	23.5	4.4
Asian Women	258	2.3	18.6	29.5	30.2	15.1	6.6
White Women	3857	34.9	22.5	28.8	29.6	14.4	4.7
URM Men	374	3.4	28.6	27.8	21.9	16.3	5.3
Asian Men	565	5.1	30.8	24.1	28.8	6.5	9.7
White Men	5713	51.8	41.8	26.3	17.8	8.6	5.5

Note. The categories for Latino, Native American, and African American have been collapsed into the category "underrepresented minority" (URM).

Asian women are also similarly positioned in terms of small numbers, except that they are more likely to be associate professors than URM women in this sample. White women constitute slightly more than one third of the sample (34.9 percent) but are also concentrated at the lower ranks compared to white men. URM men are more likely to be represented at the full professor level compared to underrepresented women of color. In contrast, white men are predominant among the full professor ranks and are least likely to be represented among assistant professors or in lecturer/instructor tracks. There is no question that inequalities associated with power and authority shape the experiences of women of color in the academy (CMPWSE, 2007; Conley, 1998; Valian, 2006; Trower & Chait, 2002) and while not all analyses in this report control for rank and tenure, acknowledging these differences is important when reviewing comparative differences between groups.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

Relationships with Colleagues

The departmental social climate is a critical factor affecting the experiences of women of color in STEM (Liefshitz et al., 2011). Specifically, the small number of female ethnic minority women in STEM creates unique challenges for those trying to climb the professoriate ladder. Given the few women in their departments, female professors typically have few or no senior female colleagues to serve as role models or mentors (Rosser, 2004), putting these individuals at risk of failing to understand their role within their department, having lowered beliefs about their competency, and feeling a reduced sense of belonging (Ponjuan et al., 2011). A lack of senior female and/or underrepresented minority mentors also limits awareness of unstated rules for promotion and tenure (Williams and Williams, 2006) and limits access to advice on navigating the workplace, important social networks, and professional opportunities within the STEM field (Rosser, 2004; Williams and Williams, 2006). Women cite a lack of mentorship and or guidance as a major influence on their decision to leave the sciences (Preston, 2004).

Relationships with colleagues are critical for women of color in STEM because they aid in their advancement and retention. In a study of over 6,800 tenure-track faculty — a third of whom were in STEM disciplines — Ponjuan and colleagues (2011) found that female and African American faculty were significantly less satisfied, compared to their white male colleagues, with their relationships to senior colleagues. Junior female STEM faculty also reported concerns with the relationships they had with similarly ranked colleagues in their departments, in particular reporting that they felt left out of the camaraderie that developed among young colleagues (Fox, 1996). Cross and Madsen's

(1997) review of gender research demonstrates that women are more likely than men to desire relationships and connectedness with others. It may be that women faculty are more aware of the quality of interactions that take place in the STEM work environment and may place a higher value on those relationships (Callister, 2006).

In interviews with female faculty in STEM disciplines, Rosser (2004) found that the lack of camaraderie and inclusion in the department community does not necessarily improve as one moves up the professoriate rank ladder and into the role of full professor. In fact, for some women it worsens (Rosser, 2004) and may include “a lack of support from colleagues and rude or unsympathetic students” (CMPWASE, 2007, 98). In a survey of female faculty in tenured senior positions in science and engineering, women faculty reported feeling invisible and marginalized within their departments and excluded from participating in important decisions affecting the departments (MIT, 1999).

Data from the HERI survey probe several of these issues. Table 2 shows that 69.7 percent of URM women feel their research is valued by faculty in their departments. Although it is a positive sign that over two-thirds of URM women feel their research is valued, it remains alarming that URM women are the least likely of any groups to share this sentiment, especially compared to Asian men (83.3 percent) and white men (79.3 percent). Within every racial group, women are less likely than men to feel that their research is valued by faculty in their departments. A second survey item reflects how much faculty feel they have to work to gain respect. Both URM (79.1 percent) and Asian women (80.9 percent) feel as though they have to work harder than colleagues to be perceived as a legitimate scholar. Interestingly, Asian men (74

percent) are also more likely to feel this is the case. This is indicative of how intersections of race and gender manifest differently and may be driven by STEM disciplinary contexts.

Table 2.
Work Environment: Percent of STEM Faculty Answering "To some extent" or "To a great extent" to the Respective Statement

	White	URM	Asian
My research is valued by faculty in my department			
Male	79.3**	77.0	83.3**
Female	72.7	69.7	77.6
I have to work harder than my colleagues to be percieved as a legitimate scholar			
Male	52.4**	60.1**	74.0
Female	66.6*	79.1	80.9

Note. Significant comparisons with URM females; *p < .05. **p < .01.

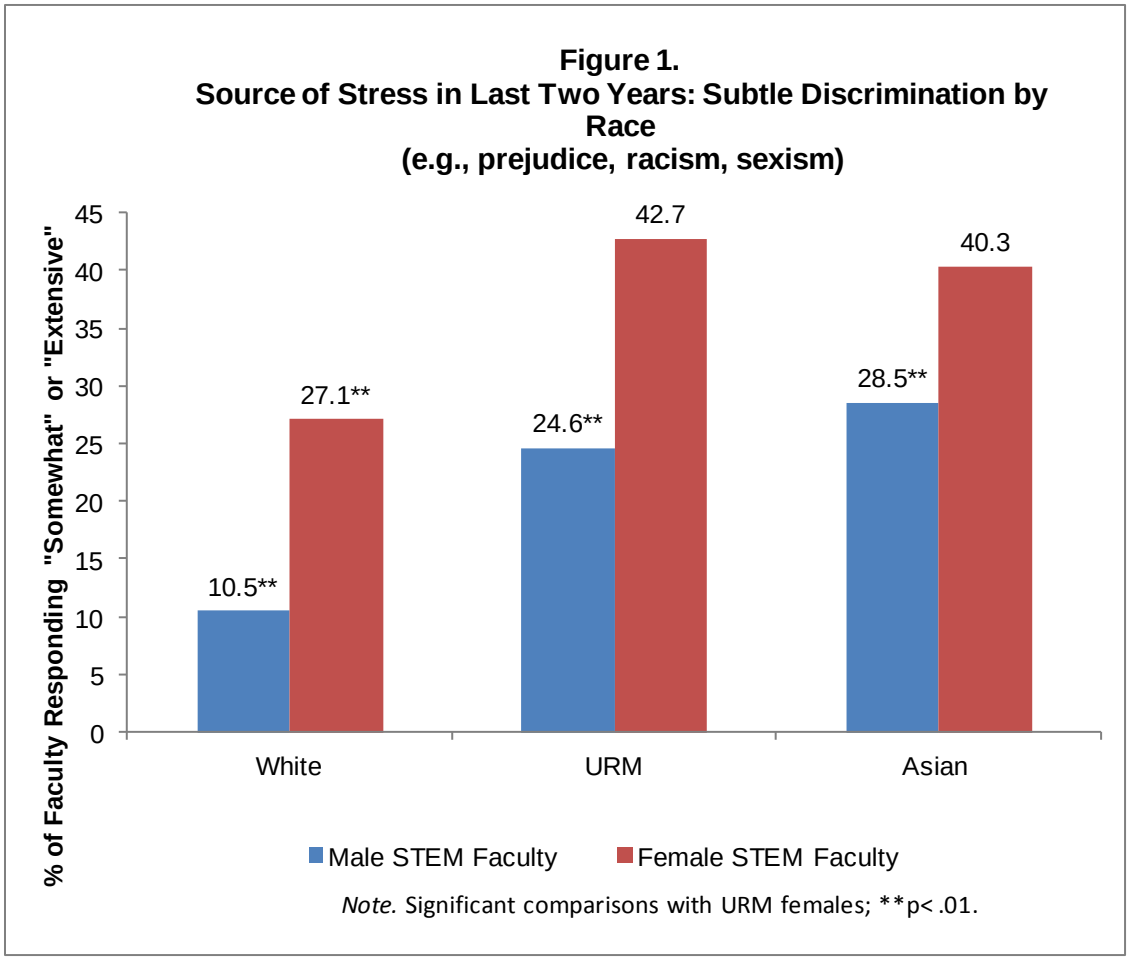
STEM disciplines dominated by males are perceived as more prestigious than those with more women (Hill et al., 2010; Rosser, 2004). Working in a male-dominated field, female STEM professionals are typically judged as being less competent than their male peers (Heilman et al., 2004). Unfortunately, research demonstrates that racial and gender bias influences the judgments of those evaluating the work and competency of female and underrepresented faculty throughout their STEM career, making it more likely that their abilities, leadership, research contributions, accomplishments, and roles will be undervalued (CMPWASE, 2007; Valian, 2006). Not surprisingly, white women and individuals from ethnic minority groups report that they must work harder than their white male peers to gain similar levels of recognition or status (Conley, 1998). The data presented in this paper confirm that such is the case among current STEM faculty.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

Bias and Sources of Stress

Severe underrepresentation or “solo status” activates stereotyping in work and learning environments (Kanter, 1977; Thompson and Sekaquaptewa, 2002). Stereotyping also contributes to limited opportunities for those from stereotyped groups (Brown et al., 2003). Because incidents of biases—however small they may be—accumulate, they often translate to large differences in opportunities and advancement over the course of one’s career (CMPWASE, 2007). Figure 1 shows how STEM faculty compare regarding subtle discrimination as a source of stress. The data show that URM women of color (42.7 percent) and Asian women (40.3 percent) are more likely than other groups to report experiences of subtle discrimination. This is a clear illustration of the intersectional role race and gender play in the workplace experiences of those in the academy. Men from every racial/ethnic group are less likely than females to report subtle discrimination as a source of stress, and women of color (including Asians) are uniquely affected.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.



It should be noted, however, that subtle discrimination is not the only or primary source of stress among underrepresented minority women faculty in STEM. National data have typically shown gender differences in sources of stress among faculty, and more recent research indicates that this is still largely the case (Hurtado et al., 2012b). Table 3 shows the top sources of stress disaggregated for the first time by URM/white designation and gender among STEM faculty. The top sources of stress are ranked in descending order according to the proportion of individuals from the respective groups that marked having experienced “somewhat” or an “extensive” amount of stress in the last two years due to the stressor. Comparisons are drawn across the STEM faculty.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

The top stressors for all faculty in the country, regardless of discipline, are *lack of personal time* and *self-imposed high expectations* (Hurtado et al., 2012b). The patterns indicate clear gender differences within URM faculty and white faculty on specific issues. Underrepresented minority women are significantly more likely than URM and white men to indicate *lack of personal time* as a key area of stress. Although there are many similarities in sources of stress between URM women and white women, a significantly greater proportion of white women identify *self-imposed expectations* as a source of stress compared to URM women; URM women and men as well as white men are equally as likely to indicate self-imposed expectations as being a primary source of stress.

URM women are also significantly more likely than URM men (p=<.05) and white men (p=<.01) to report *managing household responsibilities* as a source of stress. Similarly, white women are more likely than men from both groups to report this as a source of stress. Over two-thirds of URM women report working with underprepared students and institutional budget cuts as a top source of stress; there are no significant differences across groups on these two issues, however. URM women are more likely (65.8 percent) than white men (57.9 percent) to report *personal finances* as a source of stress. They appear to share similar levels of stress from finances with URM men and white women. *Research and publishing demands* rank as a top stressor for URM women (61.8 percent) as it does for the other groups. White men are significantly more likely than URM women to cite *institutional procedures and red tape* as a source of stress.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

Surprisingly, white women (68.3 percent) are more likely than URM women (61 percent) to report *teaching load* and *students* (69.6 percent vs. 58.5 percent) as sources of stress. Although this data demonstrates that students can be a source of work stress for women of color, other studies have shown how working with students can also be a rewarding part of faculty life. For example, women of color in STEM attributed mentoring younger generations of scientists, especially other women and people of color, as an important contributor to their persistence and sense of purpose (Liefshitz et al., 2011). Women of color who worked in STEM fields in which women were severely underrepresented (e.g., astrophysics) considered mentoring students as a personally rewarding experience because it provided them with a much needed sense of connection and strength (Liefshitz et al., 2011).

Table 3.
Percentage of Faculty By Race Responding Having Experienced "Somewhat" or an "Extensive" Amount of Stress in the Last Two Years Due to the Following Stressors:

Top Ten Stressors for URM Female Faculty in STEM	URM Women	URM Men	White Women	White Men
Lack of personal time	86.4	69.7**	88.5	76.8**
Self-imposed high expectations	82.4	79.4	88.0*	79.5
Managing household responsibilities	79.0	66.8*	80.5	68.5**
Working with underprepared students	69.9	63.3	74.5	69.6
Institutional budget cuts	66.0	64.2	66.5	64.0
Personal finances	65.8	65.7	59.6	57.9*
Research or publishing demands	61.8	61.9	65.0	63.8
Institutional procedures and red tape	61.0	62.6	67.2	68.9*
Teaching load	61.0	56.3	68.3*	60.0
Students	58.5	51.7	69.6**	60.1

Note. Significantly different from URM women faculty; *p < .05. **p < .01.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

Responsibilities and Research

Because of their small numbers, women of color are typically overburdened with an expectation to be on more committees or to advise more students than their white or male counterparts, although these service activities are not particularly rewarded during promotion and tenure considerations (Edmondson Bell and Nkomo, 2001; Rosser, 2004; Thompson, 2000). More time engaging in service activities may translate to less time for research. Table 4 shows the percent of STEM tenure-track faculty spending five or more hours a week on specific tasks related to the faculty role. The data appear to confirm previous research that URM women spend more time in *committee work or meetings* and *advising/counseling students* than white men. URM women are similar to minority males and white and Asian females, however, in the amount of time they spend on these activities. One particularly troubling finding is that women of color appear to spend less time on research and writing than their male colleagues from all groups. Further analyses revealed significant differences in the amount of time spent on research and writing between women of color and men (URM, white, and Asian) at the full professor and assistant professor ranks, but no significant differences at the associate professor level. White and Asian women are similar to URM women on time spent on advising, committee work, and research, but differ on reported time spent on teaching. Specifically, a higher percentage of white women report spending five or more hours per week on scheduled teaching and preparing for teaching than other STEM faculty.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

Table 4.
Percent of STEM Tenure-Track Faculty Working 5+ Hours/Week on Respective Task

	White		URM		Asian	
	Male	Female	Male	Female	Male	Female
Advising Counseling Students	38.5*	43.6	42.7	48.5	43.2	44.3
Committee Work or Meetings	36.1**	43.8	38.6	48.5	32.3**	40.8
Research and Scholarly Writing	59.8*	44.9	66.2**	49.5	73.3*	60.2
Scheduled Teaching	74.7	77.4*	74.1	67.3	66.5	74.6
Preparing for Teaching	79.8	84.1*	78.5	76.4	76.7	82.1

Note: Significant differences with URM females; *p < .05. **p < .01.

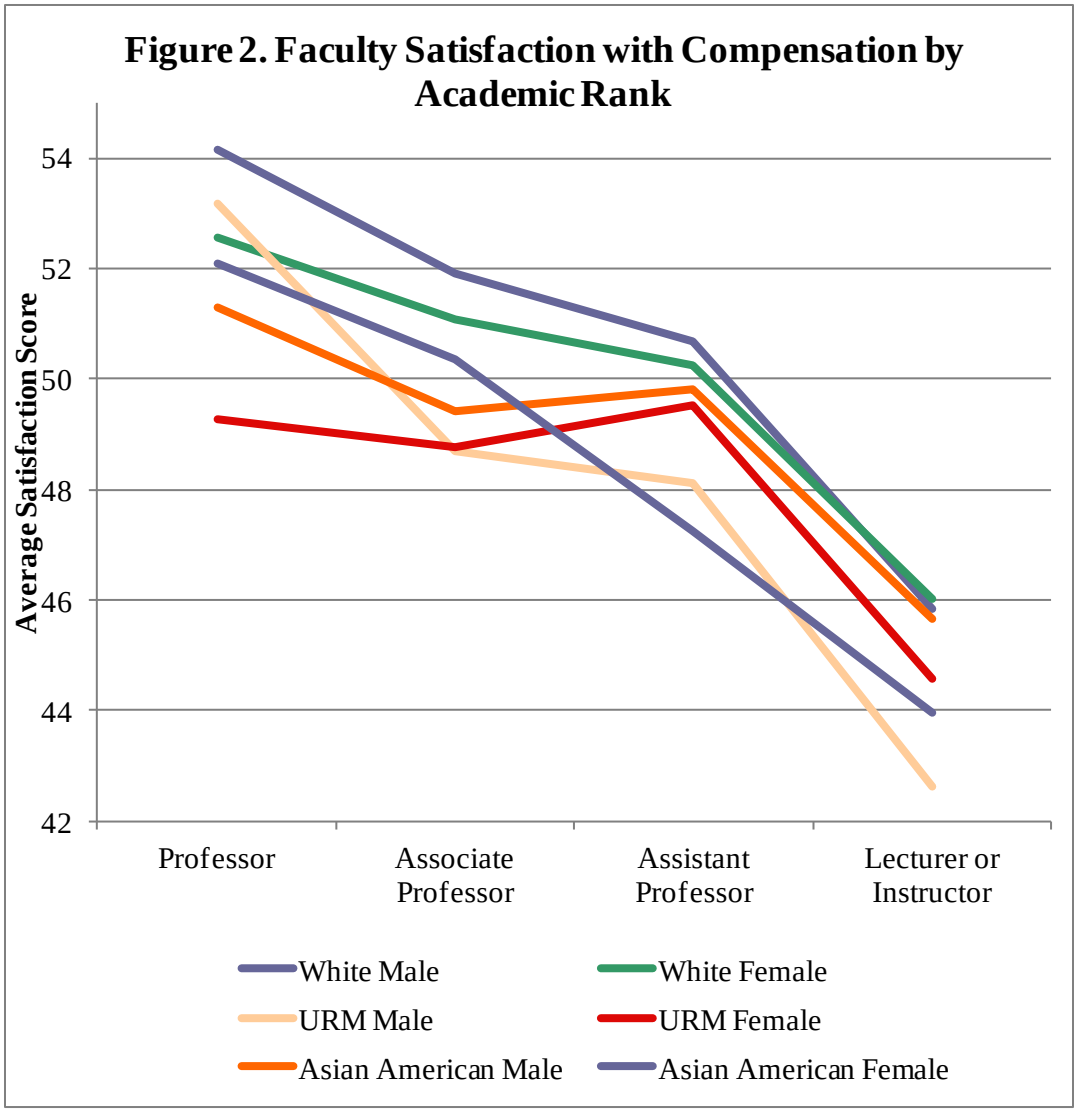
Opportunities to engage in valued departmental and workplace assignments are a critical factor in the professional advancement of women of color in STEM, because it gives them exposure to the experiences they need to be considered a competitive applicant to other positions (Liefshitz et al., 2011). Differential access to opportunities and resources is a barrier to research and publication productivity and may be the root of the productivity gap between men and women faculty (Xie and Shauman, 1998). Specifically, when institution type, teaching load, funding, and research assistance are controlled for, the gender productivity gap disappears (Xie and Shauman, 1998). Sex disparities in funding, physical space, and staff support have an important influence on the career satisfaction and advancement of female faculty working in STEM disciplines (Brown et al., 2003).

Satisfaction with Compensation

Scales are often used with faculty data to compare groups on average levels of satisfaction across several correlated items, which are constructed using Item Response Theory. The compensation scale (mean set at 50) is a unified measure of

faculty responses to satisfaction on six survey items that address salary, retirement benefits, teaching load, job security, opportunities for scholarly pursuits, and prospects for career advancement. Figure 2 shows the responses by rank, race, and gender. Underrepresented minority women at the full professor level (red line) are least satisfied with their compensation compared with any other group. They are similar to URM males in below-average satisfaction at the associate professor level. In contrast, white males are most satisfied with compensation at every rank. For every group, lecturers and instructors are the least satisfied with compensation, with URM males being especially dissatisfied. These findings are cause for concern, considering that job dissatisfaction is often a precursor to leaving academia.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.



A severe lack of women of color in senior faculty positions partly reflects the fact that men are more likely to be tenured in STEM disciplines than women, even after controlling for factors such as year since degree was attained, discipline, parental status, and other important variables (Long, 2001). Women faculty in STEM are also promoted at a slower pace than men and have a smaller probability of reaching the highest academic rank, especially at Research 1 institutions (CMPWASE, 2007). These realities may partially explain why female faculty holding professorial rank in various

fields across the academy express a lack of confidence in the equity of the tenure process, in which they acknowledge that their male colleagues do not understand the sacrifices they make to remain devoted to their career (Wasburn, 2004). The data we present in this paper adds to this narrative, in that they reveal considerably less satisfaction with compensation among tenured URM women in STEM disciplines.

Work–Life Balance

Another complication for women faculty is the significant tension that exists between a woman's personal life and a STEM academic career model that rewards those who demonstrate an unlimited availability to work, even if this comes at the expense of a balanced personal life or one's family (Brown et al., 2003; Trower, 2008). Falling short of this expectation by taking time off for personal or family reasons or placing a great amount of attention on another responsibility—like children or elderly relatives — puts one at risk of appearing less serious about her career (Rosser, 2004). Not surprisingly, few women on the tenure track take advantage of the benefits to which they are entitled —like those that can slow the tenure clock —out of fear that it will hamper their career progression (Wasburn, 2004). The HERI STEM faculty data show that 21.2 percent of URM women reported that they interrupted their professional career for one year or more due to family reasons. This is not significantly different than white women (18.8 percent) or Asian women (13.3 percent). We do not know, however, if they stopped the tenure clock during this interruption or if the interruption took place at a key transition point, like after having successfully reached tenure. Career interruption for family reasons was significantly less prevalent among men: Only 6.8 percent of URM, 4.1 percent of white, and 3.1 percent of Asian men reported that they did so.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

Indeed, women are more concerned than their male colleagues about a lack of institutional support for having a family while on the tenure track (Trower and Chait, 2002). In a questionnaire distributed to female scientists and engineers, almost three quarters of participants reported that one of the most significant challenges facing women scientists today as they plan their careers is balancing work with family responsibilities (Rosser, 2004). Work–life balance issues also have a great influence on the family planning decisions of female professors (Rosser, 2004) and eventually take a toll on career satisfaction (Trower, 2008), especially for women of color who are likely to have more responsibilities to extended family and to their communities (Edmondson Bell and Nkomo, 2002). Women who left the sciences cite difficulty managing both work and family responsibilities as one of the main factors influencing their decision to leave (Preston, 2004). Alternatively, having a balanced life by engaging in intellectual, creative, and enjoyable activities out of the realm of science helped women of color in STEM disciplines cope with the pressures they faced in the workplace and promoted their achievement in science (Liefshitz et al., 2011).

Conclusion

Understanding the factors that reinforce the cycle of inequality in career mobility, satisfaction, and work–life opportunity is the first step in creating solutions that will advance women of color in STEM. Professional isolation, irrespective of field and sex, is a common factor influencing faculty decisions to leave an institution (Hill et al., 2010; UCB, 2001). Among female faculty members in science and engineering fields, in particular, lower levels of job satisfaction and higher intentions to quit is a reality with which post-secondary institutions must contend (Callister, 2006). Fortunately these

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

outcomes are mediated by department climate (Callister, 2006), suggesting that a supportive work environment can go a long way toward improving the career satisfaction of women of color in academia (Wasburn, 2004). Attrition of women of color can be prevented and addressed through activities that overcome the solo status associated with severe underrepresentation in a field. Further, the contexts in which women of color work and learn can be key moderators of success, particularly those that build social and academic networks within the department and across the institution. These networks are essential to providing information about how to navigate an academic career and create pathways to resources (e.g., funding, knowledge, technology).

From an institutional standpoint, the tenure and reward system and processes must be transparent and must accommodate more woman-centered policies regarding family and work–life issues. National data show that women are not only more likely than male faculty to experience more stress related to household and family responsibilities, but also more likely to experience stress from providing care for an elderly parent (Hurtado et al., 2012b). These demands are a fact of life for women, and flexible campus policies remain necessary.

Institutions must undertake specific initiatives to improve the work–life conditions for women of color and women in the academy. First, centrally conducted salary equity studies create an institution-wide check on disparities within departments. Provosts can request that deans and department chairs review the gaps associated with specific salary differences to consider corrective action. Second, studies can be conducted of women faculty who are considering leaving the institution and/or have left in order to

identify patterns in a local context and potential institutional policy solutions. Third, funding for activities should be provided to assist in workshops and intellectual collaborations that reduce isolation and address key problems associated with underrepresentation. Finally, information about zero tolerance policies and appropriate procedures for dealing with harassment and incidents of discrimination should be widely disseminated on a campus. Faculty are now required to participate in sexual harassment training at many public institutions, but additional training models should be constructed to identify how racial bias operates in academic settings. These policies and procedures should be sensitive to the safety and career concerns of women of color in the academic workplace.

By taking these first steps and others, institutions demonstrate a serious commitment to retaining women of color in STEM throughout the different stages of their career trajectory. This should be a high priority at the institutional and national level. The women of color in academia today are the survivors of many encounters with difference and experiences shaped by underrepresentation. We need to do all we can to retain them so that they are available for the next generation of women and minorities entering science.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.

References

Aguirre, A., R. Martinez, and A. Hernandez. 1993. Majority and minority faculty perceptions in academe. *Research in Higher Education* 34(3):371-385.

Association of American Medical Colleges (AAMC). 2005. The changing representation of men and women in academic medicine. *AAMC Analysis in Brief* 5(2):1-2. Retrieved from September 1, 2012, from https://www.aamc.org/download/75776/data/aibvol5no2.pdf

Brown, A., W. Swinyard, and J. Ogle. 2003. Women in academic medicine: A report of focus groups and questionnaires, with conjoint analysis. *Journal of Women's Health* 12(10):999-1008.

Callister, R.R. 2006. The impact of gender and department climate on job satisfaction and intentions to quit for faculty in science and engineering fields. *Journal of Technology Transfer* 31:367-3.

Committee on Maximizing the Potential of Women in Academic Science, Engineering (CMPWASE). 2007. *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering*. Washington, DC: National Academies Press.

Conley, F. K. 1998. *Walking Out On The Boys.* New York: Farrar, Straus, and Giroux.

Cross S.E. and L. Madsen. 1997. Models of the Self: Self Construals and Gender. *Psychological Bulletin* 122(1):5-37.

DeAngelo, L., S. Hurtado, J. H. Pryor, K. R. Kelly, J. L. Santos, and W. S. Korn. 2009. *The American College Teacher: National Norms for the 2007-2008 HERI Faculty Survey*. Los Angeles: Higher Education Research Institute, UCLA.

Edmondson Bell, E.L.J., and S. M. Nkomo. 2001. *Our Separate Ways.* Cambridge, MA: Harvard Business School Press.

Fox, M. F. 1996. Women, academia, and careers in science and engineering. Pp. 96-121 in *The Equity Equation: Fostering the Advancement of Women in the Sciences, Mathematics, and Engineering*. C. S. Davis, A. B. Ginorio, C. S. Hollenshead, B. B. Lazarus, and P. M. Rayman, eds. San Francisco: Jossey-Bass.

Ginther, D.K., and S. Kahn. 2012. Education and academic career outcomes for women of color in science and engineering. Paper presented at the conference for the Committee on Women in Science, Engineering, and Medicine, Washington, DC, June 7, 2012.

Heilman, M. E., A. S. Wallen, D. Fuchs, and M. M. Tamkins. 2004. Penalties for success: Reaction to women who succeed in male gender-typed tasks. *Journal of Applied Psychology* 89(3):416–27.

Hill, C., C. Corbett, and A. St. Rose. 2010. *Why So Few? Women in Science, Technology, Engineering, and Mathematics.* Washington, DC: American Association of University Women. Retrieved September 1, 2012, from http://www.aauw.org/learn/research/upload/whysofew.pdf

Hurtado, S., M.K. Eagan, and B. Hughes. 2012a. Priming the pump or the sieve: Institutional contexts and URM STEM degree attainments. Paper presented at the Annual Forum of the Association for Institutional Research, New Orleans, LA,

June 4, 2012.
Hurtado, S., M. K. Eagan, J. P. Pryor, H. Whang, and S. Tran. 2012b. *Undergraduate teaching faculty: The 2010-11 HERI faculty survey.* Los Angeles: Higher Education Research Institute.
Hurtado, S., K. A. Griffin, L. Arellano, and M. Cuellar. 2008. Assessing the value of climate assessments: Progress and future directions. *Journal of Diversity in Higher Education* 1(4):204-221.
Kanter, R. M. 1977. Some effects of proportions on group life: Skewed sex ratios and responses to token women. *American Journal of Sociology* 82:965-89.
Liefshitz, I., C. Wright, A. Hodari, L. Ko, and M. Ong. 2011. Life stories of the double bind: Women of color in physics, astrophysics and astronomy. Unpublished manuscript. Boston, MA: TERC.
Long, J. S. 2001. *From scarcity to visibility: Gender differences in the careers of doctoral scientists and engineers*. Washington, DC: National Academies Press.
Massachusetts Institute of Technology. 1999. A study on the status of women faculty in science at MIT. *MIT Faculty Newsletter* 11(4). Retrieved September 1, 2012, from http://web.mit.edu/fnl/women/women.htm
Ponjuan, L., V. M. Conley, and C. Trower. 2011. Career stage differences in pre-tenure track faculty perceptions of professional and personal relationships with colleagues. *The Journal of Higher Education* 82(3):319-346.
Preston, P.E. 2004. *Leaving Science: Occupational Exit from Scientific Careers.* New York: Russell Sage Foundation.
Reay, D. 2007. Future directions in difference research: Recognising and responding to difference in the research process. Pp. 605-612 in *The Handbook of Feminist Research: Theory and Praxis.,* S. N. Hesse-Biber, ed. London: SAGE Publications, Inc.
Rosser, S.V. 2004. *The Science Glass Ceiling: Academic Women Scientists and the Struggle to Succeed.* New York, N.Y.: Routledge.
Thompson, J.J. 2000. Finding their way. *PRISM* (March):20-25.
Thompson, M. and D. Sekaquaptewa. 2002. When being different is detrimental: Solo status and the performance of women and racial minorities, *Analyses of Social Issues and Public Policy* 2(1):183-203.
Trower, C. A. 2008. *Competing on culture: Academia's new strategic imperative.* Presented at [insert conference and city where it was presented, if possible], October. Retrieved September 1, 2012, from http://www.advance.iastate.edu/conference/conferencepdf/2008_10-11trower_ppt.pdf
Trower, C. A., and R. P. Chait. 2002. Faculty diversity: Too little for too long. *Harvard Magazine* (March-April):33-37, 98. Retrieved September 1, 2012, from https://faculty.diversity.ucla.edu/gender-equity/women-in-science-and-engineering/030233HarvardMagazine.pdf
University of Colorado at Boulder (UCB). 2001. *Faculty Recruitment and Retention Task Force Report.* Retrieved September 1, 2012, from *www.colorado.edu/AcademicAffairs/fac_recruit/fac_recruit.doc*
Valian, V. 2006. Beyond gender schemas: Improving the advancement of women in academia. Pp. 320-332 in *Removing Barriers: Women in Academic Science,*

Technology, Engineering, and Mathematics, J.M. Bystydzienski and S.R. Bird, eds. Bloomington: Indiana University Press.

Wasburn, M. H. 2004. Appeasing women faculty: A case study in gender politics. Advancing Women in Leadership Website. Retrieved September 1, 2012, from http://www.advancingwomen.com/awl/spring2004/WASBURN.html

Williams, B.N., and S. Williams. 2006. Perceptions of African American male junior faculty on promotion and tenure: Implications for community building and social capital. *Teachers College Record* 108(2):287-315.

Xie, Y., and K. A. Shauman. 1998. Sex differences in research productivity: New evidence about an old puzzle. *American Sociological Review* 63(6):847-870.

* in press (proceedings of National Academy of Sciences: Prepared for *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*). June 2012, Washington, DC.