2021 ASEE ANNUAL CONFERENCE
Virtual Meeting | July 26–29, 2021 | Pacific Daylight Time
Paper ID #34135

Faculty Mentorship and Research Productivity, Salary, and Job Satisfaction

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Abstract

Studies have shown that mentorship is critical to the career and professional development of workers, including postsecondary faculty. Evidence from the literature on faculty-to-faculty mentorship has generally come from the medical field and/or focused only on the academic institution where the study was conducted. This study extends the literature by examining data reported by faculty across multiple institutions and fields in the Early Career Doctorates Survey (ECDS). Guided by a theoretical framework adapted from Higgins and Kram (2001), multiple linear regression models are applied to investigate which factors are associated with faculty attainment of mentorship, and how mentorship of faculty is associated with faculty productivity, salary, and job satisfaction. In contrast to previous literature, results indicate that women and men have similar likelihood of reporting having a formal/informal mentor, and that Black/African American faculty are more likely to report having a formal/informal mentor compared to White faculty. Furthermore, receiving mentorship does not appear to be associated with increased productivity or job satisfaction, but is associated with a 10% higher salary among faculty who reported having a mentor. These results, however, are limited to observable outcomes in the ECDS, and the benefits to mentoring may extend beyond those, including well-being, sense of belonging, and other variables not measured in the dataset. Overall, research findings contribute to existing efforts and ongoing conversations on faculty mentorship by offering additional evidence from a nationally representative sample, providing a benchmark for academic institutions to evaluate their professional development programs for faculty.

Introduction

Evidence from the literature has shed light on the importance of mentorship on the career and professional development of contemporary workers (e.g., Allen et al., 2004; Bjursell & Sädbom, 2018; Eby et al., 2008). However, research on mentorship has largely focused on organizational work settings (Allen et al., 2004; Kram & Isabella, 1985) and on undergraduate and graduate students (Crisp & Cruz, 2009; National Academies, 2019), with much less attention to the antecedents and benefits of mentorship provided to faculty members. Nevertheless, mentorship has been shown to be critical to professional development and career satisfaction among faculty, such that formal mentoring programs for faculty have proliferated across academic institutions (e.g., Lunsford, 2018; Martínez et al., 2011; Muschallik & Pull, 2016). Given these benefits, many scholars and administrators view mentorship as a way to support a diverse professoriate by enhancing the work experiences and retention of faculty across fields, with important implications for enhancing the effective support and teaching of undergraduate and graduate students. Despite continued efforts to promote mentorship of faculty, studies show that early career scholars may not be receiving the mentorship that they require (Morzinski &

Fisher, 2002; Thomas, 2001; Van Noorden, 2018). Informed by Higgins and Kram's (2001) framework of the antecedents and consequences of the mentoring (developmental) network, our study applies multiple linear regression models to investigate the following two research questions regarding faculty mentorship and professional development:

(1) Which factors are associated with the likelihood that a faculty member will report having a formal or informal faculty mentor?

(2) What are the associations between faculty mentorship and career outcomes, including number of peer-reviewed articles, number of conference presentations, salary, and job satisfaction?

Previous studies on mentoring faculty have largely focused on medical fields (Levinson et al., 1991; Palepu et al., 1998; Reid et al., 2012). Our study extends the literature by focusing on faculty working across a wider range of fields, including engineering, science, health, and social sciences, as well as across different academic institutions, by analyzing nationally representative data from the National Science Foundation Early Career Doctorates Survey (ECDS). Research findings demonstrate whether the likelihood of having a formal/informal mentor differs across faculty subgroups, and identify the associations between receiving mentorship and faculty career outcomes, including research productivity, salary, and job satisfaction. Since the data are nationally representative, research findings offer a broad view of faculty mentorship, providing a benchmark for individual academic institutions to develop potential interventions and identify opportunities related to mentorship to enhance faculty success.

Background

Likelihood of Having a Mentor by Gender and Race/Ethnicity

The evidence on whether there is a difference in likelihood of having a mentor is mixed and dependent on context. Evidence from the literature on postsecondary students has shown that women and underrepresented racially minoritized (URM) students have less access than White students to faculty mentors (e.g., Nelson, 2015). Overall, evidence from the literature has shown the difficulties and challenges faced by women and URM scholars in academia (Atkinson et al., 1991; Brown et al., 1999; Dunham et al., 2012; Long et al., 2018). Studies in the management field have also argued that the lack of mentorship hinders the career of women and URM employees in nonacademic job sectors (e.g., Carli & Eagly, 2016; Cox & Nkomo, 1991; Servon & Visser, 2011).

Previous research has also investigated the faculty-to-faculty mentorship experiences of women and URM in academia (Dunham et al., 2012; Evans & Cokley; 2008; Long et al., 2018; Zambrana et al., 2015). For example, Evans and Cokley (2008) argued that African American women have limited access to academic mentorship because of discrimination on the basis of sex and race. The lack of mentorship, along with other challenges associated with developing a thriving research portfolio, has hindered progress to faculty promotions and tenure (Evans & Cokley, 2008). Dunham et al. (2012) interviewed women faculty who participated in mentorship

programs, and found that some mentorship programs do not provide equitable mentorship during the mentoring process.

Although qualitative studies have highlighted the challenges faced by women and URM faculty in mentoring, findings from quantitative studies differ. Quantitative studies by Holliday et al. (2014) and Lunsford et al. (2018), for example, do not find that women or URM faculty have a lower likelihood of having a mentor relative to men and White colleagues. Holliday et al. (2014) found that the likelihood of having a mentor among radiation oncologist residents does not differ by gender or race/ethnicity. Lunsford et al. (2018) examined a sample of faculty in liberal arts colleges in the U.S. and found that the likelihood of having a mentor is similar among men and women. Since the findings related to the likelihood of having a mentor is mixed based on research approach, as well as by context, we contribute to the literature by investigating mentorship of faculty in engineering, as well as in other fields, working across a number of academic institutions in the U.S.

Mentorship and Career Outcomes

Many studies have shown that mentorship is associated with productivity among early- and mid-career faculty members. However, the evidence has largely come from studies in the medical field, and consequently, whether it is not clear whether this finding applies to other fields (Illes et al., 2000; Morzinski et al., 1996; Palepu et al., 1998; Paul et al., 2002). Illes et al. (2000), for example, evaluated a mentoring program consisting of 19 junior radiology faculty at the Stanford University School of Medicine. Based on Likert scale ratings and qualitative responses, Illes et al. (2000) found that mentoring positively increases research performance of junior faculty. Palepu et al. (1998), used cross-sectional survey data of full-time faculty at 24 randomly selected U.S. medical schools. Palepu et al. (1998) found that medical faculty who had a mentor have higher self-ratings on their research preparation and research skills relative to medical faculty without a mentor. While the majority of studies have suggested positive associations between mentorship and productivity, there are some exceptions (e.g., Riechelmann et al., 2007). Using a survey sample consisting of 339 oncologists and a linear regression approach, Riechelmann et al. (2007) found that mentorship is not associated with a higher number of self-reported publications or on becoming a principal investigator.

There are also studies on mentorship of faculty outside of the medical field. Martínez et al. (2011) used data from a 5-item, short-answer questionnaire completed by 51 highly productive psychology scholars to examine the reasons behind their productivity. Using a qualitative design, Martínez et al. (2011) concluded that mentoring is an effective strategy to increase productivity. Muschallik and Pull (2016) used data from 368 senior researchers in the fields of business administration and economics from academic institutions in Austria, Germany and the German-speaking part of Switzerland. Despite evidence from the literature suggesting that informal mentorship may be more effective since it is more likely for informal mentors and mentees to develop personal ties beyond professional relationships (e.g., Higgins & Kram, 2001; Higgins & Thomas, 2001; Hezlett & Gibson, 2007), Muschallik and Pull (2016) found that mentees in formal mentoring programs are more productive than mentees in informal mentoring programs. They also found that mentees in formal mentoring programs are more productive than researchers who did not participate in mentoring.

Using cross-sectional survey data comprised of 415 liberal arts college faculty members, Lunsford et al. (2018) showed that a higher quality mentoring relationship is positively associated with the job satisfaction of mentees. Similarly, Schrodt et al. (2003) found that faculty with mentors feel higher levels of satisfaction with their socialization process, more connected in their work environment, and also reported receiving adequate information on departmental expectations. Wasserstein et al. (2007) also consistently found that having mentors is positively associated with overall job satisfaction among medical faculty at the University of Pennsylvania, and the associations are similar for women and men.

There are a number of studies that specifically focus on how mentorship influences the experiences and outcomes of women and URM faculty (Allen et al., 2018; Evans & Cokley; 2008; Levinson et al., 1991). For example, Levinson et al. (1991) used data from a cross-sectional national survey conducted by the American Association of Medical Colleges (AAMC). Focusing on 558 full-time women faculty who are in departments of medicine in the United States and with an age of 50 and younger, Levinson et al. (1991) found that women faculty who had a mentor during training are significantly more likely to have more publications. Also, by interviewing African American faculty in schools of social work, Allen et al. (2018) found that having mentors enhances the scholarship and productivity of African American faculty.

Contributions of this Study

Given the various potential benefits of mentorship, many scholars and administrators view mentorship as an effective way to enhance the work experience of faculty in academia, and as a way to increase faculty retention (e.g., Byars-Winston et al., 2018; Dunham et al., 2012; Evans & Cokley; 2008; Sorcinelli & Yun, 2007). Although there is robust literature on faculty mentorship and career outcomes, few studies examine faculty mentorship across multiple fields and across academic institutions. Further, the findings regarding the likelihood of having a mentor and the associated outcomes of mentorship are mixed depending on the methods used and the institutional context. We use Higgins and Kram's (2001) mentoring framework to inform our analyses, considering the antecedents and the consequences of mentorship. We contribute to the literature by drawing inference from a nationally representative sample of faculty in engineering, science, health, and social sciences. Our dataset, the ECDS, includes comprehensive data that we use to control for relevant confounding factors to examine the conditional associations between mentorship and career outcomes. Our findings therefore provide a view of the landscape of faculty mentorship in the U.S.

Theoretical Framework

To conceptualize mentoring behavior, Higgins and Kram (2001) applied fundamental concepts from social networks theory and related methods to propose a "developmental network" to model mentoring as a multiple relationship phenomenon. In their model, Higgins and Kram (2001) integrated related factors that may contribute to the formation of this network. The resulting mentoring (developmental) network from Higgins and Kram (2001) highlights several key elements, including antecedents, mediating processes, moderators, developmental network structure, and the outcomes for the protégé. We adapted Higgins and Kram's (2001)

developmental network to the academic mentoring context, and our adapted framework is illustrated in Figure 1.

Our data from NSF ECDS provide comprehensive information regarding the faculty respondent's background, perceived needs for development, current experiences and level of productivity, as well as engagement with a mentor and other developmental and help-seeking behavior. We mapped the available survey data to the elements of our adapted theoretical framework (Fig. 1). Using the ECDS data, we first examined the likelihood of having a mentor in accordance with the factors related to antecedents, mediating processes, and moderators (Fig. 1). We considered variables that may be associated with faculty-to-faculty mentoring. Furthermore, in the second research question, we evaluated how mentoring is associated with productivity, salary, and job satisfaction for the protégé, according to the "developmental consequences for protégé" section of our theoretical framework.

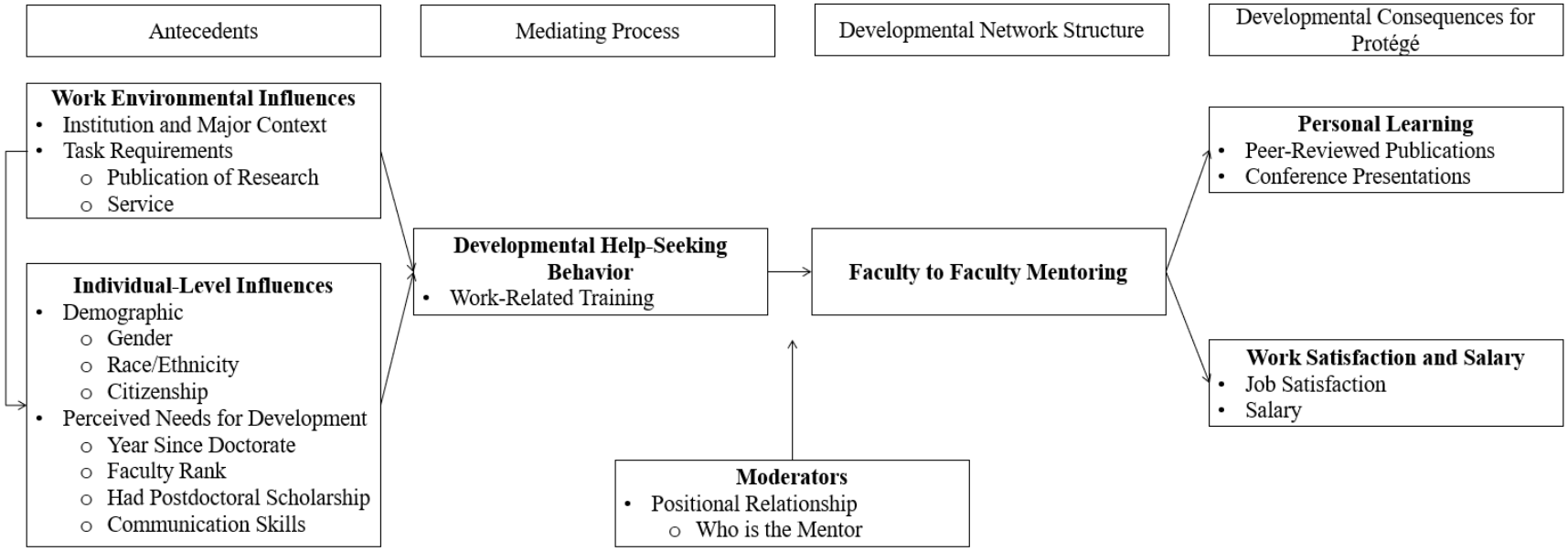
Data

We analyzed the National Science Foundation Early Career Doctorates Survey (ECDS) dataset. The ECDS is a nationally representative survey of individuals working at a U.S. academic institution, federally funded research and development center (FFRDC), or the National Institutes of Health Intramural Research Program (NIH IRP) in 2014/2015. There are several advantages associated with the ECDS data. First, it is a nationally representative survey on postsecondary faculty, and thus results from our study reflect data from more contemporary cohorts of faculty. In addition, the ECDS has comprehensive data, including demographic and individual-level factors, PhD institution and program characteristics, and measures regarding how well PhD programs prepare students for their faculty position in terms of skill sets. These aforementioned variables are aligned with our adapted theoretical framework (Fig. 1).

We restricted our analytical sample to individuals with a science, engineering, or social science PhD, and to those who hold a teaching position within the U.S. Thus, our sample includes tenure-track faculty, lecturers and other non-tenure track teaching personnel, and excludes postdoctoral scholars. A limitation of our study is that the ECDS data does not distinguish formal mentors from informal mentors, and previous research has shown that the experiences of mentees may differ based on formal or informal mentorship (Higgins & Kram, 2001; Higgins & Thomas, 2001; Hezlett & Gibson, 2007; Muschallik and Pull, 2016). The summary statistics of our sample are presented in Table 1. In Table 1 Column 1, we present the summary statistics for all 416 STEM faculty in our sample. Meanwhile, Table 1 Column 2 presents the summary statistics of the 175 STEM faculty who reported having a formal/informal mentor. Compared to the average faculty member in the sample, faculty who reported having a mentor are more likely to be women, URM, and have more recently earned their PhD degree. Faculty who earned a PhD degree in bio & health science are disproportionately more likely to have a mentor. Also, faculty with the job requirement of full-time commitment to research and publication are more likely to have mentors. Faculty who self-indicated that their job requires "mentorship for professional development" are similarly likely to have mentors relative to those who do not have this requirement.

Figure 1

Mentoring (Developmental) Theoretical Framework



Note. The Mentoring (Developmental) Theoretical Framework is adapted from Higgins and Kram (2001).

Table 1

Summary Statistics

	All	With Mentor
Demographic/Individual (Proportion)		
Gender		
Women	0.50	0.57
Race/Ethnicity		
Asian	0.19	0.19
Black/African American	0.05	0.07
Hispanic/Latinx	0.06	0.08
White	0.68	0.65
Other	0.02	0.01
Individual Characteristics		
U.S. citizenship	0.76	0.74
Year Since Doctorate	5.79	5.28
Had Postdoctoral Position	0.23	0.22
PhD Institution, Field, and Financial Support (Proportion)		
PhD institution in U.S.	0.92	0.91
PhD Field		
Bio & Health Science	0.26	0.32
Physical Science	0.04	0.02
Other Sciences	0.17	0.12
Psychology & Social Sciences	0.43	0.44
Engineering	0.10	0.10
Financial Support		
Fellowship/Grant	0.59	0.63
Other	0.41	0.37
Doctorate Preparation (1-5 Likert scales)		
Analytical Skills		
Research Methodologies	3.59	3.63
New Ideas	3.55	3.49
Analyzing Findings	3.65	3.69
Understanding of Subject Area	3.64	3.66
Communication Skills		
Working Constructively	3.48	3.46
Influencing Others	3.30	3.25
Communicating in Writing	3.38	3.33
Communicating in Small Groups	3.50	3.52
Communicating in Presentations	3.53	3.54
Planning, Managing and Delivering	3.36	3.29
Job Requirement (Proportion)		
Full-Time Commitment to Research	0.32	0.41
Publication of Research	0.65	0.72

Service	0.81	0.78
Mentorship	0.32	0.34
Faculty Rank (Proportion)		
Assistant Professor	0.45	0.51
Full/Associate Professor	0.23	0.20
Lecturer/Instructor/Other	0.32	0.29
Productivity (Number)		
Peer-Reviewed Articles After PhD	5.90	6.63
Conference Presentations After PhD	7.16	6.70
Log Salary (Log $)	11.05	11.15
Job Satisfaction (Proportion)		
Very Dissatisfied	0.04	0.05
Dissatisfied	0.06	0.04
Neither Dissatisfied nor Satisfied	0.18	0.11
Satisfied	0.43	0.49
Very Satisfied	0.29	0.31
Has a Mentor (Proportion)	0.39	1.00
N	416	175

Note. Missing values are omitted from calculations on an item-by-item basis.

Methods

Research Question 1: Which factors are associated with the likelihood that a faculty member will report having a formal or informal faculty mentor?

We used a multiple linear regression model to estimate the likelihood that a faculty member will report having a formal or informal mentor. The factors for the antecedents and mediating processes are drawn from our theoretical framework in Figure 1. As a robustness check, we also executed our models with Logit and Probit alternatives, and our qualitative conclusions are the same. Note that our regression model used survey weights and accounted for the stratified sampling of the survey data. Our regression form is as follows:

$$y_i = \boldsymbol{\beta} * \boldsymbol{D_i} + \boldsymbol{\gamma} * \boldsymbol{P_i} + \boldsymbol{\delta} * \boldsymbol{J_i} + \varepsilon_i, \quad (1)$$

In equation (1), y_i denotes the dependent variable of whether a faculty member *i* reported having a formal or informal mentor. The vector $\boldsymbol{D_i}$ denotes the demographic/individual level factors, which include gender, race/ethnicity, U.S. citizenship, and whether the individual had a postdoctoral scholarship before obtaining the faculty position. We also included a year since PhD fixed-effect to control for cohort effects. We used $\boldsymbol{P_i}$ to denote the factors related to doctoral training, which include whether the PhD institution is located in the U.S., the broad doctorate field (including bio & health science, physical science, other sciences, psychology & social

sciences, and engineering), financial support during doctoral training, self-perceived rating of whether the doctoral program prepared the individual well for their first position in terms of communication skills. Further, we used $\boldsymbol{J_i}$ to denote factors related to their current position, including job requirements (full-time commitment to research, publication of research, service, and mentorship for professional development), work-related training, and faculty rank. The vectors of $\boldsymbol{\beta}, \boldsymbol{\gamma}$ and $\boldsymbol{\delta}$ denote the regression coefficients, and ε_i denotes the error term.

While our empirical models include the antecedents and mediating processes from our theoretical framework, we do not include variables pertaining to the characteristics of mentors, which is shown as moderators in Fig. 1. For context, we examined the positions of the faculty mentors, and these results are presented in Table 2. Table 2 shows that most mentors are senior colleagues from the same academic department or are the respondents' former PhD advisors. Since respondents can have more than one mentor, the identities of mentors are not mutually exclusive.

Table 2

Identity of Mentors

Current Supervisor	0.43
Previous Supervisor	0.37
Senior Colleague from the Current Position	0.64
Senior Colleague from a Previous Position	0.32
Other Colleague	0.50
PhD Advisor	0.70
Other	0.02

Research Question 2: What are the associations between faculty mentorship and career outcomes, including number of peer-reviewed articles, number of conference presentations, salary, and job satisfaction?

For this research question, we considered the following four career outcomes indicated during the survey year (2014/2015): number of peer-reviewed articles, number of conference presentations, salary, and job satisfaction. We run a series of multiple linear regression models, with the following regression form:

$$y_i = \boldsymbol{\beta} * \boldsymbol{D_i} + \boldsymbol{\gamma} * \boldsymbol{P_i} + \boldsymbol{\delta} * \boldsymbol{J_i} + \pi * M_i + \varepsilon_i, \quad (2)$$

Note that the function form of equation (2) is the same as that of equation (1), except that we used an additional binary term M_i to indicate whether individual *i* has a formal/informal mentor. While we used the same set of explanatory variables in this regression model, the outcome variable, y_i, now represents (a) the cumulative number of peer-reviewed articles after PhD completion; (b) the cumulative number of conference presentations after PhD completion; (c) log salary, or (d) the rating of job satisfaction from a scale of 1 to 5 (very dissatisfied, dissatisfied, neither dissatisfied nor satisfied, satisfied, very satisfied). We examined each of the outcome

variables (a) – (d) in a separate regression. Note that our results are robust to reasonable transformations of our outcome variables; for example, using the quantile forms of the cumulative number of peer-reviewed articles after PhD completion instead of the cumulative number of peer reviewed articles, using raw salary instead of log salary, or using a binary form of satisfaction, rather than the Likert scores.

Although our models take into consideration the antecedents and mediating processes described in our theoretical framework, in describing our results, we only focus on the conditional associations between having a mentor and the outcomes described above, which is shown as the coefficient of π in our equation (2). To further examine the potential differential associations between mentorship and career outcomes by year since PhD completion, in addition to the regression analysis above, we decomposed our analysis by plotting the career outcomes along the y-axis, with the years since PhD completion along the x-axis. We illustrated each career outcome in a separate panel. Each panel compares the career outcome of faculty with and without mentors. The 95% confidence interval for each line is also shown (see Fig. 2).

Limitations

There are several limitations associated with our study. As described above, our data do not distinguish between formal and informal mentors, and previous research shows that this distinction may matter. Although our data are nationally representative, our focus on faculty and instructors limits the sample size, such that it is possible that important statistical relationships may not be detected due to the lack of power. Our data also do not include other important variables, such as specifics regarding the mentoring relationship or how mentorship varies by the identity or characteristics of the mentor. Since we examine a more recent cohort of faculty, it is possible that many may have already received professional development and preparation for future faculty roles while as PhD students. Finally, our empirical approach is descriptive, and therefore do not show causal relationships due to issues associated with endogeneity.

Results

Research Question 1: Which factors are associated with the likelihood that a faculty member will report having a formal or informal faculty mentor?

In Table 3, we present our regression results for research question 1. For the antecedent-level factors, in terms of work environment, we found that PhD field is significantly associated with having a mentor. That is, compared to faculty in biology and health sciences, faculty in other sciences are 20.1 percentage points less likely to have a mentor. We also found that job requirement is strongly associated with having a mentor. Faculty with the job requirement of full-time commitment to research are 12.6 percentage points more likely than those who do not have this requirement to have a mentor. Meanwhile, faculty with the job requirement of publication of research are 14.1 percentage points more likely than those who do not to have a mentor. However, faculty with a job requirement of service are 14.5 percentage points less likely than those who do not have this requirement to have a mentor.

In terms of individual-level factors, consistent with the evidence from the literature (e.g., Lunsford et al., 2018), we did not find that women and URM faculty have a lower likelihood of reporting having a mentor. Moreover, Black/African American faculty are 21.4 percentage points more likely to report having a formal or informal mentor than White faculty are, and this difference is statistically significant. We did not find that other individual characteristics, such as PhD institution or financial support, are strongly associated with the likelihood of reporting having a formal or informal mentor.

As described in the methods section, our model incorporates a year since doctorate fixed-effect. The coefficients from the fixed-effect are statistically significant, indicating that junior faculty are more likely to report having a formal/informal mentor. The regression coefficients of the year since doctorate fixed-effect are not shown in Table 3 for brevity. We do not find that faculty rank, communication skills, or previous postdoctoral positions is associated with reporting having a formal or informal mentor. In terms of mediating processes from the theoretical model (Fig. 1), we did not find that work-related training is associated with having a mentor.

Research Question 2: What are the associations between faculty mentorship and career outcomes, including number of peer-reviewed articles, number of conference presentations, salary, and job satisfaction?

In columns 1 to 4 of Table 4, we present results from the four career outcome variables, including the cumulative number of peer-reviewed articles after PhD completion, the cumulative number of conference presentations after PhD completion, log salary, and the numeric score on the Likert scale response to the survey question on job satisfaction. While we present all of the regression coefficients in Table 4, we only focus our discussion on the parameter of interest—whether the faculty member has a mentor. We found that faculty with mentors are more likely than those without a mentor to earn relatively higher salaries. Faculty with mentors earn 10% higher, or $9,800 in annual salary more, relative to those without a mentor, holding all else constant. Although having a mentor is associated with 0.85 more peer-reviewed publications after the PhD, the association is small and not statistically significant. We did not find evidence suggesting that mentorship is associated with job satisfaction or number of conference presentations after the PhD.

Table 3

Regression Results: Likelihood of Reporting Having a Mentor

	Coeff.	Std. Err.
Demographic/Individual		
Gender		
Women	0.083	(0.053)
Race/Ethnicity		
Asian	-0.016	(0.080)
Black/African American	0.214**	(0.102)
Hispanic/Latinx	0.153	(0.115)
Other	-0.317*	(0.184)
Individual Characteristics		
U.S. citizenship	-0.019	(0.066)
Had Postdoctoral Position	0.021	(0.067)
PhD Institution, Field, and Financial Support		
PhD institution in U.S.	0.008	(0.100)
PhD Field		
Physical Science	-0.161	(0.122)
Other Sciences	-0.201**	(0.076)
Psychology & Social Sciences	-0.078	(0.065)
Engineering	-0.120	(0.093)
Financial Support		
Other	0.021	(0.055)
Job Requirement		
Full-Time Commitment to Research	0.126**	(0.056)
Publication of Research	0.141**	(0.067)
Service	-0.145*	(0.080)
Mentorship	0.032	(0.064)
Work-Related Training		
Participated	0.028	(0.050)
Faculty rank		
Full/Associate Professor	-0.002	(0.072)
Lecturer/Instructor/Other	-0.037	(0.067)
N	416	

Notes. ***/**/* denote significance levels 0.01/0.05/0.10, respectively. The baseline groups of race/ethnicity, doctorate field, financial support, and faculty rank are White, bio & health science, fellowship/grant, and assistant professor. Year since doctorate fixed-effect and communication skills are included in the model, but not shown in the model.

Table 4

Regression Results: The Associations Between Mentorship and Career Outcomes

	(1) Peer-Reviewed Articles After PhD	(2) Conference Presentations After PhD	(3) Log Salary	(4) Satisfied with Position
Has a Mentor				
Yes	0.854	-0.241	0.098**	-0.008
	(0.861)	(0.964)	(0.046)	(0.102)
Demographic/Individual Characteristics				
Gender				
Women	-0.523	-0.286	-0.041	-0.002
	(0.894)	(0.960)	(0.042)	(0.113)
Race/Ethnicity				
Asian	-0.833	-0.218	-0.091*	0.117
	(1.282)	(1.172)	(0.051)	(0.165)
Black/African American	-0.621	-1.234	-0.049	-0.283
	(1.771)	(1.507)	(0.067)	(0.318)
Hispanic/Latinx	-1.134	-1.985	-0.031	-0.285
	(1.742)	(2.178)	(0.070)	(0.251)
Other	0.317	9.112	-0.096	-0.485
	(2.404)	(5.717)	(0.097)	(0.448)
Individual Characteristics				
U.S. citizenship	-0.995	0.915	-0.043	0.336**
	(1.148)	(1.474)	(0.059)	(0.166)
Had Postdoctoral Position	1.158	-0.943	-0.689***	0.133
	(1.055)	(1.237)	(0.055)	(0.145)
PhD Institution, Field, and Financial Support				
PhD institution in U.S.	0.794	-0.206	0.078	0.151
	(1.463)	(2.460)	(0.089)	(0.192)
Doctorate Field				
Physical Science	-2.490*	-2.129	-0.267*	0.082
	(1.465)	(2.280)	(0.149)	(0.158)
Other Sciences	-3.121**	-3.419**	-0.063	-0.026
	(1.309)	(1.433)	(0.065)	(0.163)
Psychology & Social Sciences	-3.130***	1.945	-0.145**	0.132
	(1.073)	(1.213)	(0.056)	(0.134)
Engineering	-3.622***	-2.359	0.029	-0.254
	(1.353)	(1.537)	(0.067)	(0.184)
Financial Support				

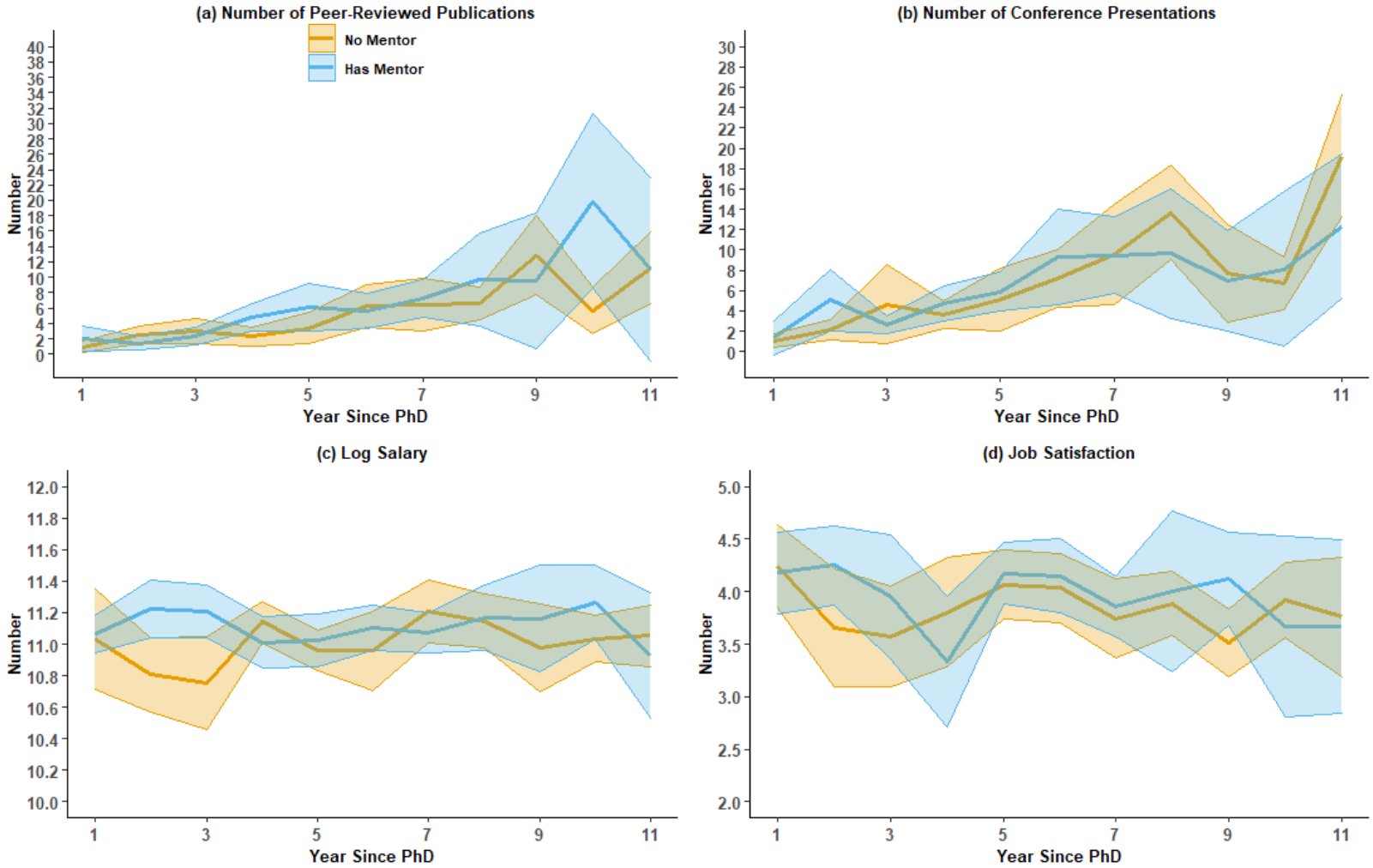
Other	-1.076	0.283	-0.030	0.039
	(0.773)	(1.148)	(0.048)	(0.124)
Job Requirement				
Full-Time Commitment to Research	4.387***	2.347**	0.240***	0.110
	(0.945)	(1.130)	(0.048)	(0.126)
Publication of Research	2.978***	2.554**	-0.045	0.205
	(1.045)	(1.167)	(0.052)	(0.192)
Service	0.785	-0.580	0.142**	-0.237
	(0.884)	(1.168)	(0.054)	(0.168)
Mentorship	1.251	-1.855*	-0.129**	0.015
	(0.942)	(0.939)	(0.050)	(0.113)
Work-Related Training				
Participated	-0.679	0.779	0.001	0.081
	(0.736)	(1.062)	(0.040)	(0.120)
Faculty Rank				
Full/Associate Professor	1.461	1.071	-0.044	-0.141
	(1.153)	(1.703)	(0.069)	(0.172)
Lecturer/Instructor/Other	0.584	-0.966	-0.092*	0.052
	(1.082)	(1.354)	(0.050)	(0.119)
N		416		

Notes. ***/**/* denote significance levels 0.01/0.05/0.10, respectively. Each column represents a separate model. The baseline groups of race/ethnicity, doctorate field, financial support and faculty rank are White, bio & health science, fellowship/grant, and assistant professor. Year since doctorate fixed-effect and communication skills are included in the model but not shown.

We also plot the employment outcomes by mentorship status and year since PhD completion in Figure 2. Note that the shaded areas denote the 95% confidence interval. Each panel represents cross-sectional data, such that each compares individuals with different years of post-PhD work experience as of 2014/2015. That is, the panels do not represent the same individuals across time. Figure 2 shows four different panels: (a) the cumulative number of peer-reviewed articles after PhD completion, (b) the cumulative number of conference presentations after PhD completion, (c) log salary, and (d) job satisfaction in the current position on a scale from 1 to 5. The covariates are not used to generate the figures, and therefore the figures do not represent the conditional associations found in Table 4. Nevertheless, our results in Figure 2 and Table 4 are generally consistent with one another. Comparing faculty with the same number of years of experience since PhD completion, those with mentors have a higher number of peer-reviewed articles, as well as higher salaries, than faculty without mentors. The average salary among faculty with and without mentors is significantly different in year 2. However, given the small sample size, the career outcomes of faculty with and without mentors are not statistically different.

Figure 2

Employment Outcome by Mentorship Status and Years Since PhD Completion



Note. The shaded areas denote the 95% confidence interval

Discussion

Our theoretical framework, adapted from Higgins and Kram (2001), informed our study by providing insights regarding the antecedents, mediating processes, and the developmental consequences of mentoring. Consistent with the theoretical framework, which suggests that work environment matters, our results indicate that the likelihood of reporting having a formal or informal mentor is associated with the academic field of the faculty member. Faculty in biology and health sciences are more likely than faculty in engineering and in other fields to report having a formal or informal mentor. Much of the previous research on mentorship has largely focused on faculty in the medical sciences, and our findings are consistent that mentorship may be more prevalent in fields related to biology and health sciences (Levinson et al., 1991; Palepu et al., 1998; Reid et al., 2012). Our theoretical framework also suggests that individual characteristics, such as gender and race/ethnicity, may matter in terms of attainment of a mentor, whereas previous literature are mixed on their findings (e.g., Evans & Cokley, 2008; Holliday et al., 2014; Lunsford et al., 2018). We found that women and men are similarly likely to report having a formal/informal mentor consistent with Lunsford et al. (2018), whereas Black/African American faculty are more likely than White faculty to report having a formal/informal mentor. The latter finding is in contrast to previous findings from qualitative studies (e.g., Evans and Cokley,2008), and thus needs further investigation, especially given the relatively small sample size of our study.

In terms of the associations between mentorship and the career outcomes we investigated, unlike evidence from previous literature (e.g., Allen et al., 2018; Illes et al., 2000; Levinson et al., 1991; Riechelmann et al., 2007), we did not find a positive association between mentorship and research productivity or job satisfaction. Rather, we found mentorship to be associated with higher salaries, holding all other factors in the model constant. Because our findings differ from previous studies that have found that mentorship to be associated with positive outcomes, further work needs to be conducted to unpack the benefits of mentoring and the processes through which mentoring is more effective. It is possible that our findings differ from previous literature because our sample encompasses faculty from multiple fields and across different academic institutions. Mentorship appears to be context-dependent, and our focus on a number of fields may mask context-specific returns to faculty mentorship. We also examine only a subset of potential outcomes associated with faculty mentorship, including research productivity, salary, and job satisfaction. However, the benefits of mentorship may be found in areas not measured in our study, such as sense of belonging in the department, reduced levels of stress, and greater camaraderie and commitment to the institution. Related to research productivity, it is possible that the benefits of mentorship may be seen in grantsmanship, development of new research programs, or in effective mentoring of graduate students. Since our sample size is relatively small, future work will include a larger sample size of newer cohorts of faculty in the 2017 wave of the ECDS. This larger sample size will allow us to examine mentorship across fields and within each field to identify variation by context. Relevant to the engineering education literature, focusing on faculty in engineering will provide insights on mentorship and the associated returns within this field, especially since much of the research has focused on faculty in medical fields.

Conclusion and Implications

Based on a nationally representative sample of faculty across multiple fields, including engineering, and academic institutions, our multiple regression results indicate that women and men have similar likelihood of reporting having a formal/informal mentor, and that Black/African American faculty are more likely to report having a formal/informal mentor compared to White faculty. Our results also show that while mentorship is not associated with increased productivity or job satisfaction, faculty with mentors earn a 10% higher salary than faculty who did not report having a formal/informal mentor.

Stakeholders can potentially apply our findings toward developing strategies and institutional policies to provide greater access to formal and informal mentorship for faculty in engineering, social sciences, and other fields, in addition to biological and health sciences. For example, fields such as engineering should consider more deliberately promoting mentorship programs to their faculty, and evaluating the outcomes associated with mentorship specific to their field. Relative to other fields, women, Black/African American, and Hispanic/Latinx faculty are underrepresented in engineering (e.g., Main et al., 2020; National Science Foundation, 2019). Since previous studies have shown the benefits associated with academic mentorship focusing on women and URM faculty members (e.g., Allen et al., 2018; Levinson et al., 1991), it is critically important to investigate how engineering fields can leverage mentorship to support women and URM faculty in engineering (e.g., McGee et al., 2021).

Faculty members across all fields can potentially apply our findings to inform their decisions regarding finding and working with a formal or informal mentor. Although our findings do not show a positive association between mentorship and research productivity or job satisfaction, previous research have documented these returns (e.g., Illes et al., 2000; Morzinski et al., 1996; Palepu et al., 1998; Paul et al., 2002). We show that faculty with informal/formal mentors have relatively higher salaries than those who do not, which suggests that mentors may provide valuable information regarding navigating the faculty career pathway and engaging in activities that may enhance their remuneration. Overall, the evidence from our study and previous literature suggests that mentorship is associated with positive benefits. Future studies focusing on engineering specifically and other types of career outcomes not measure in this study will further extend the literature.

Acknowledgments

This material is based upon work supported by the National Science Foundation under Grant Number 1653378. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. The authors thank the National Center for Science and Engineering Statistics for providing data for analyses, and to the SPHERE research group for feedback.

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