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Case Study of U.S. Federal Research Workforce Diversity: Interactions of Social Networks, Race-Ethnicity, and Gender in Job Attainment

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Abstract

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We investigated employment diversity patterns, including interactions between social networks and employee demographics such as race-ethnicity and gender. In 2012–2014, we randomly interviewed 183 of the total of about 300 employees of the U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station (PNW), asking them how they learned of their first PNW job. Several results displayed patterns with race-ethnicity and gender, including the following: (1) males were more likely than females to have learned of their PNW job through nonsocial means (e.g., websites); (2) when finding out about their job from another person, White employees were more likely to have been informed by males, and non-Whites were more often informed by females; and (3) males were more likely to have been hired into jobs with higher pay grades. The PNW scientist workforce we sampled was predominantly White and male, which may have contributed to the overall PNW workforce being predominantly White and male, along with the higher percentage of men in jobs at higher pay grades.

Keywords: Employment, hiring, informant, nonsocial, underserved communities.

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Introduction

The U.S. population is becoming increasingly diverse, but workforce diversity lags. In particular, the federal government workforce ideally represents all American citizens, implementing the workplace vision of justice and equity by applying existing laws and policies to ensure that no discrimination occurs against a job applicant or employee based on race, color, religion, sex, disability, or genetic information (EEOC 2016). These laws and policies have resulted in a corresponding workforce that reflects the full gamut of the U.S. population served by the federal government (Kingsley 1944, Krislov 1974, Mosher 1968, Selden 1997). Nevertheless, major underrepresented groups have not attained job equity among the constantly changing U.S. population in federal workplaces. Herein, we present a case study addressing the interactions of race-ethnicity, gender, and social networks in job acquisition.

Race-Ethnicity and Gender

Race-ethnicity and gender have been dominant dimensions of federal employment inequities. In 2010, Hispanic-Latino employees comprised 8 percent of the federal workforce (OPM 2016), but this group made up more than twice that proportion (16.3 percent) of the overall U.S. population (fig. 1) (Humes et al. 2011). In contrast, other minority groups were well represented; the 2010 federal workforce included 17.7 percent Black, 5.6 percent Asian, and 1.8 percent American Indian/Alaska Native employees (OPM 2016), which exceeded U.S. population proportions from the 2010 census (Humes et al. 2011). Figure 1 shows the 2010 population to have been 12.6 percent Black, 4.8 percent Asian, and 0.9 percent American Indian/Alaska Native.

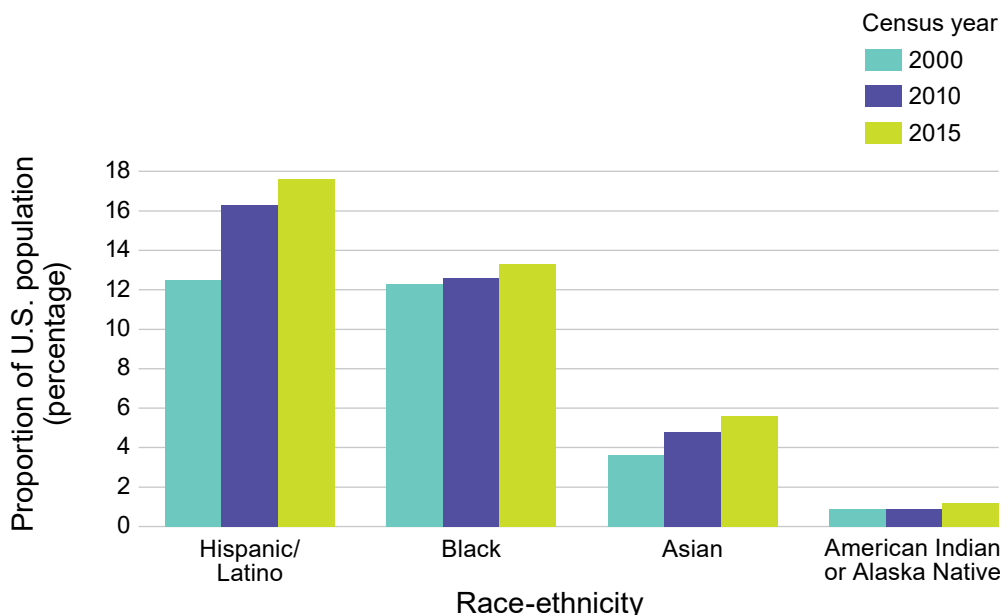


Figure 1—Main race-ethnicity groups for the U.S. population in 2000, 2010, and 2015 (data are from the U.S. Census Bureau (Humes et al. 2011, USDC CB 2016)).

Relative to gender, although about half of the U.S. population is female (USDC CB 2016), only 43.9 percent of U.S. federal workforce employees were women in 2010, and this number dropped to 43.2 percent in 2014 (OPM 2016). Underrepresentation of women is a particular challenge in some workforce sectors such as science, technology, engineering, and mathematics (known as “STEM” fields) (Conti and Visentin 2015, Moss-Racusin et al. 2012, Reuben et al. 2014), in which gender and race-ethnicity inequalities have been noted (e.g., Arismendi and Penaluna 2016, Ginther et al. 2011). For example, Arismendi and Penaluna (2016) reported gender and race-ethnicity for U.S. professionals in fisheries science as follows: (1) in the academic community (colleges and universities), 15 to 29 percent of faculty were women and 9 to 11 percent were non-White (Black, Hispanic-Latino, Asian, or other), depending on position type; and (2) in the U.S. federal fisheries sector, 26 percent of scientists and managers were women and 9 percent were non-White. These workforce numbers contrasted with the broader participation of doctoral students in general biological sciences, in which 52 percent were women and 31 percent were non-White (Miller and Wai 2015) and the 2010 U.S. census, in which 51 percent were women and 36 percent were non-White (Arismendi and Penaluna 2016).

Addressing Workplace Diversity

Several contemporary efforts have specifically addressed workplace diversity and inclusion in U.S. federal agencies. In the U.S. Department of Agriculture (USDA), Secretary Thomas Vilsack introduced the concept of “transformation” in late 2010. The following year, President Obama issued Executive Order 13583 “Establishing A Coordinated Government-Wide Initiative to Promote Diversity and Inclusion in the Federal Workforce.” That same year, USDA Forest Service Chief Thomas Tidwell advanced the issue as “cultural transformation.” The Forest Service’s national leadership released an intention statement for the agency, “To create a culture of inclusion that awakens and strengthens all people’s connection to the land.”

The processes leading to employment are complex, with both preapplication and postapplication components. Applicant pools may become skewed from preapplication processes affecting knowledge of or access to job openings. Specifically, we know little about how underserved populations learn of job opportunities within federal agencies. However, research in public administration has elevated diversity-related issues, including racial integration of federal agencies (Kellough 1990, Kellough and Elliot 1992). Overall, public-sector organizations have tended to have more diverse employee populations than the private sector, suggesting that the public sector has been more successful in recruiting a more diverse range of employees (Cornwell and Kellough 1994, Riccucci 2002). Recruitment processes are key preapplication contexts in that they communicate

job openings, yet additional societal frameworks are involved with gaining knowledge of employment opportunities. Simply, how does a jobseeker learn of a job? Are there disparities among U.S. subpopulations in seeking and learning of jobs, via direct recruitment efforts or other information networks?

The Role of Social Networks in Employment

There is strong support for the role played by social capital (e.g., a person's social networks and societal position) (Lin 1999) in influencing the likelihood of employment; as populations with disparate social networks (Harrison and Klein 2007) compete for common jobs, inequities arise. Historically, social networks were well known to contribute to employment success, with family, friends, and interorganizational ties connecting jobseekers with job openings, especially in local community and private-sector employment (e.g., Blau and Robins 1990; Granovetter 1973, 1995; Gulati et al. 2011; Pellizzari 2010; Rees 1966; Topa 2011). Referrals can be particularly important in job hiring (Marsden and Campbell 1990), with the quality of personal references or social ties being an established component of résumés and job applications (Gulati et al. 2011). Also, neighborhood “referral effects” among persons with similar sociodemographic characteristics (e.g., family size, age) (Bayer et al. 2008) or neighborhood employment status (Jahn and Neugart 2020) may improve a person's chances of finding a job. Furthermore, the number of employed friends (Cappellari and Tatsiramos 2015), the quality of social ties (Hensvik and Skans 2016), and socioeconomic dimensions of geographic locations (Arismendi and Penaluna 2016, Bayer et al. 2008, Schmutte 2015) can affect employment patterns.

Adding complexity to these processes, information about jobs may be passed through social networks distinguished by gender or by race-ethnicity (Green et al. 1999). Fernandez and Sosa (2005) found that women usually learned of job opportunities from other women, and men more often learned of job openings from other men. For men and women who belong to the same organization, women's networks can be less central to work organizations, less influential, and less likely to provide work-related help compared to the networks of men (Ibarra 1995). From our earlier STEM example, male frameworks within scientific institutions may contribute to the underrepresentation of women (Blickenstaff 2005). Relative to race, White persons can maintain larger and more diverse networks than non-White persons (Marsden 1987). Silva (2018) showed that White applicants benefited greatly from same-race referrals, whereas Black applicants did not benefit from same-race referrals when relatively unprejudiced respondents evaluated them. Also, Black applicants benefited only when referrers were White and relatively unprejudiced respondents evaluated them. Overall, the results showed that Black jobseekers had a disadvantage in accessing employee referrals and had a

disadvantage in return from these referrals. Last, work by Pedulla and Pager (2019) found that network access and network returns varied by race. They found that Black and White jobseekers used their networks at similar rates; however, network-based methods were less likely to lead to job offers for Black Americans. However, Granovetter (1973) proposed the importance of weak societal ties among people, which in this scenario could counteract potential disadvantages resulting from primary social networks that do not lead to job offers.

Intersections of gender and race occur in social networks and job attainment. Women and minorities can be more isolated from finding out about job opportunities if they have less influential social networks, whereas White males may have significantly higher levels of access to quality jobs through White-male enclaves (i.e., “old-boy” networks) (Saloner 1985). Corcoran et al. (1980) showed that 52 percent of the time, White men found jobs using networks of friends and relatives compared to 47.1 percent for White women and 43 percent for Black women. White and Black women also relied more on advertisements than White and Black men. How jobseekers conduct their employment searches may matter; these types of behaviors could result in employment biases related to demographic and diversity groups.

In contrast to reliance on social networks for jobseeking, nonsocial means of securing employment are becoming increasingly important as jobseekers respond to Internet job postings and submit applications without the involvement of face-to-face contact with others. For U.S. government positions, the website usajobs.gov has been the go-to resource for job listings and application channels. Both the Internet and social media networks integrate nonsocial and social means of job hunting, with additional potential hiring biases related to Web access, social media relationships, knowledge of navigating such systems, and membership in social networks related to those systems.

Herein, we aimed to advance knowledge of how employees learned of their opportunity to obtain a job in a federal research institution, specifically the USDA, Forest Service, Pacific Northwest Research Station (PNW). We investigated the roles of social and nonsocial processes that PNW employees encountered when they first learned of their job opportunity, and we examined if these processes may have differed with respect to demographics such as gender, race-ethnicity, geographic location of the jobseeker, and pay grade of the job.

Methods

We conducted our study from 2012 to 2014 using a telephone questionnaire and interviewed PNW employees in Oregon, Washington, and Alaska. In 2012, there were about 300 PNW employees, including scientists, professional and technical research personnel, and administrative staff. We aimed to interview a random

sample of at least half the survey population to enable meaningful analyses and make inferences about the larger PNW employee population. We assigned a random number to each permanent employee at PNW in 2012 and contacted employees in numerical order by telephone. We obtained Institutional Review Board approval from Oregon State University and received an opinion from the USDA general counsel stating that the nature of our survey, with the intended survey population of only PNW permanent employees, was within the “scope of their federal employment” with the station director’s permission. The PNW civil rights officer and station director at that time approved our questionnaire. To maintain respondent confidentiality and anonymity, a university student (lead author Arlyn Y. Moreno Luna [AML]) with no prior ties to PNW conducted the interviews. AML coded data and maintained oversight of primary data files so that the other investigators would not know who she had interviewed and could not tie names to their responses. We derived additional PNW population data from the files of the civil rights director (e.g., breakdown of all current employees by gender, race-ethnicity, and position type) and used U.S. census data in some general comparisons of PNW race-ethnicity and gender patterns relative to the local, state, or U.S. populations.

There were two main sections of the survey. First, we asked how employees (survey respondents) found out about their first PNW job and categorized responses as using either social or nonsocial means. If the employee mentioned personal contacts (informants), we classified their source as having a social means of information. We asked about relationships between survey respondents and informants, and if there were multiple informants, we asked about any known relationships among informants. Second, we asked about the respondents’ and informants’ demographics including race-ethnicity, gender, where the respondent was living when they applied for the job, and the title and pay grade (General Schedule, GS) of the job the employee was awarded. Pay grade at hiring corresponds to pay rate, experience, and expertise and ranges from GS-1 to GS-15. Scientist positions usually require a doctoral degree, are pay grades $\geq$ GS-11, and are 4-factor positions, relating to the number of performance factors involved in their rating. Professional, technical, and administrative staff are largely 9-factor positions and are pay grades $\geq$ GS-1. Our null hypothesis was that there would be no differences among PNW employees of the various demographics in how they learned of their first PNW job, their pay grade or factor category, or where they had been living.

We analyzed respondent data using multinomial logistic regression (“proc logistic” function) (SAS Institute 2008) to assess the relationship between categorical response variables of PNW employees’ demographic groups (dependent variable: gender or race-ethnicity) and several continuous predictor variables, including the proportion of informants by gender (male or female), the pay grade of

employees' first PNW job, and an ordinal variable representing the location where respondents lived (rural-to-urban scale) when they found out about potential PNW employment. We conducted chi-square analyses to assess if there were nonrandom patterns in certain responses and to determine the main contributors to emerging patterns.

Results

In total, we surveyed 183 permanent employees at PNW over over a 2-year period between 2012 and 2014 (table 1). First, to characterize our sample population, we noted that more than half ($n = 110$, 60 percent) of respondents were male. This corresponded to the male population at PNW; in June 2014, 160 of 273 (59 percent) permanent PNW employees were male. However, this workforce was predominantly male relative to the larger American population and the populations of the three states in which PNW laboratories and research centers are located. According to the 2010 census (USDC CB 2016), the United States was 49.2 percent male, $\chi^2 = 9.68$, $df = 1$, $p = 0.002$; Oregon, 49.5 percent male, $p = 0.003$; Washington, 49.8 percent male, $p = 0.004$; and Alaska, 52 percent male, $p = 0.03$.

Table 1—Patterns of U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station (PNW) survey respondents' means of learning (social or nonsocial) of their first job at PNW, sorted by gender and race-ethnicity

Means of learning	Gender		Race-ethnicity	
	Male	Female	White	Non-White
	<i>n (percentage)</i>			
Social	71 (64.5)	58 (80.5)	110 (70.5)	16 (76)
Nonsocial	39 (35.5)	14 (19.5)	46 (29.5)	5 (24)
Total	110	72	156	21

Note: One male respondent did not recall how he found out about his job; not all respondents reported their race-ethnicity.

Second, most ($n = 156$, 85.2 percent) survey respondents were White. The entire PNW permanent workforce had 86 percent White employees, hence the respondent population was similar in terms of race-ethnicity to the larger pool of PNW employees during the time of our surveys. Non-White respondents constituted 13.5 percent ($n = 21$) of the respondent population and included Black ($n = 7$), Asian ($n = 6$), Hispanic-Latino ($n = 5$), Native American ($n = 2$), and biracial ($n = 1$) individuals. Six respondents did not specify their race-ethnicity. The American population was 72.4 percent White at the time of the 2010 census, and the PNW workforce differed significantly from that proportion ($\chi^2 = 25.6$,

$df = 1, p = 0.0001$). However, for one of three states within the research station's geographic area, Oregon, the White proportion of the state population did match the PNW workforce demography (USDC CB 2016): Oregon, 83.6 percent White ($p = 0.25$); Washington, 77.3 percent White ($p = 0.0005$); Alaska, 72.4 percent White ($p = 0.001$). Although we did not ask in what city respondents were living at the time of our survey, the PNW directory showed that most PNW employees worked out of four Oregon locations (Portland, Corvallis, La Grande, and Prineville, Oregon) as compared to Washington or Alaska field laboratories (Olympia, Seattle, or Wenatchee, Washington; Juneau, Fairbanks, or Sitka, Alaska). Hence, the White predominance of our PNW employee sample may have resulted from this Oregon state-level demographic.

The pay grade of respondents' first PNW job ranged from GS-1 to GS-15 (fig. 2a), and seven respondents did not supply their pay grade at hiring. About one-third of respondents ($n = 68$) were previously employed by the federal government before PNW hired them. Respondents most frequently were living in a small city when they first learned of PNW employment, followed by those living in medium-sized cities and living in large cities; only 7.1 percent of respondents were living in rural communities (fig. 2b).

Among the 183 survey respondents, 70.5 percent found out about their PNW job through social means from one or more persons and 29 percent through nonsocial means (e.g., job posting, websites, flyers, email list servers) (fig. 2c). Two respondents did not recall how. The most frequent nonsocial source of PNW employment information was usajobs.gov, with over half of nonsocial respondents using that method. In terms of hiring year, 24 of 28 respondents who learned of their jobs via usajobs.gov were hired in 2000 or later. For context, the usajobs.gov website was launched in 1996 (OPM, n.d.). We arbitrarily chose 2000 to split the dataset, with 95 of 183 (52 percent) respondents hired in or after that year. Of respondents who learned of PNW employment through nonsocial means, 73.6 percent were male, a higher proportion than expected by chance, given that 61 percent of survey respondents were male ($\chi^2 = 11.8, df = 1, p < 0.005$).

To assess potential predictors of respondents finding out about their jobs through social means, we used a logistic regression to examine associations with race-ethnicity, gender, and pay grade. Gender and pay grade showed significant patterns (table 2). Women were 2.5 times more likely to have used social means than males ($p = 0.010$). PNW employees who started their jobs at pay grades $\geq$ GS-11 also were 2.5 times more likely to have used social means than those starting at pay grades $<$ GS-11 ($p < 0.013$). Race-ethnicity was not related to the use of social means for job finding.

Altogether, the 129 respondents who found out about their first PNW job via social means reported a total of 190 informants telling them about job opportunities.

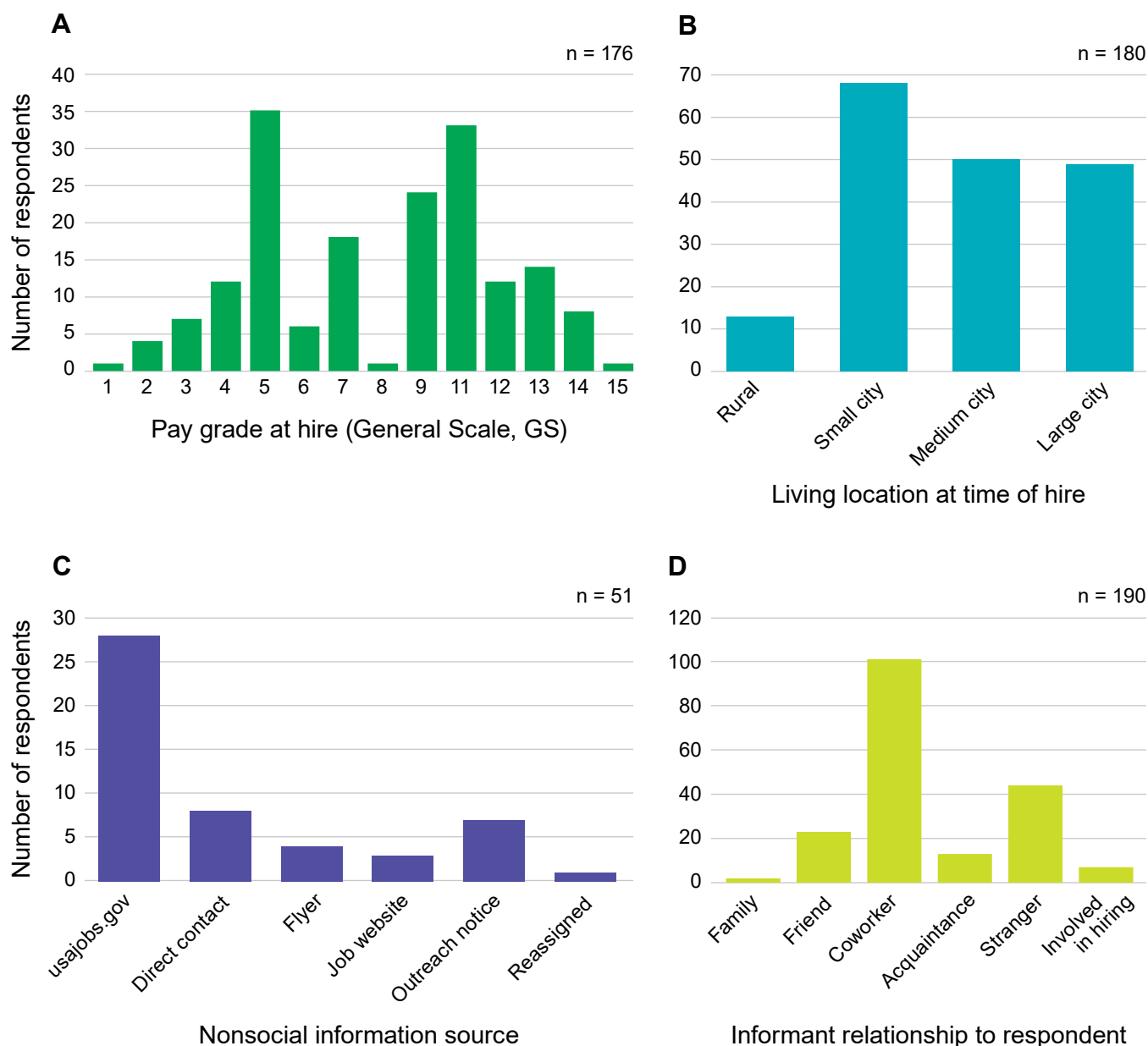


Figure 2—Demographics of the survey respondents from the U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station in 2012–2014: (A) job pay grade at hiring; (B) living location at time of hiring; (C) nonsocial job information source; and (D) social job information source, informant relationship to respondent.

Table 2—Logistic regression results of predictors of using social means for finding out about U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station jobs (*n* = 176)

Predictor	Odds ratio	<i>p</i> -value	Percentage
Race-ethnicity	0.954	0.937	–4.6
Gender	2.51	0.010	151.7
Pay grade ≥ GS-11	2.50	0.013	150.5
Constant	1.29	0.320	

Of those, seven informants were involved in the hiring process, and we eliminated them from further analyses because they were part of the hiring process. Most of the remaining 183 informants were coworkers of respondents (55.2 percent) or strangers (24.0 percent). Friends (12.6 percent), acquaintances (7.1 percent), and family members (1.1 percent) were also sources of employment information (fig. 2d); these groups were not equal: $\chi^2 = 167$, $df = 4$, $p < 0.005$. In almost all cases in which a respondent named more than one informant, all their informants knew one another; such informant networking precluded the use of additional social network analyses.

Using multinomial logistic regression, we examined the relationship between respondent race-ethnicity and gender and categorical predictor variables including pay grade, informants' gender, and the respondent's urban versus rural location at the time of hiring. Three of six analyses were significant (b, c, and f) (table 3). First, we found a relationship between the race-ethnicity of the PNW employees hired and the gender of their informants (analysis b, $p = 0.006$) (table 3). The probability that the hired person was White increased with the probability that their informant was male, and conversely, the probability that the hired person was non-White increased with the probability that their informant was female.

Table 3—Multinomial logistic regression results examining six (a–f) respondent gender and race-ethnicity relationships with other demographic predictor variables at the time of hiring, from surveys of how U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station (PNW) employees learned of their first PNW job

Analysis	Respondent group	Predictor group	n	Wald chi-square	p-value
a	Gender	Informant gender	129	1.860	0.173
b	Race-ethnicity	Informant gender	126	7.495	0.006
c	Gender	Pay grade	172	8.778	0.003
d	Race-ethnicity	Pay grade	166	0.052	0.820
e	Gender	Rural-urban	179	0.237	0.626
f	Race-ethnicity	Rural-urban	174	5.985	0.014

Second, PNW employee gender was related to the pay grade of their first job (analysis c, $p = 0.003$) (table 3). Males were more likely to be hired into higher grades ($GS \geq 11$); conversely, females were more likely to be hired into lower grades ($GS < 11$). At the highest pay grade reported (GS-15), the model predicted an approximately 80 percent probability that the new employee would be a male. We explored this finding further to see if this pattern might be the legacy of older hiring practices. We again split the sample into roughly two groups at the year 2000 and analyzed each group separately. Both groups reflected a pattern similar to the original analysis of the entire pool of employees, with males hired into higher pay

grades (hires before 2000: $n = 77$, $p = 0.047$; hires in 2000 and later: $n = 95$, $p = 0.02$). For more recent hires, in 2000 or later, there was an even more significant gender difference in pay grade at hiring, with fewer women being hired into higher pay grades. Furthermore, as a scientific research station, we recognized that scientists with doctoral degrees comprise a large proportion of PNW employees and are hired at a minimum pay grade of GS-11. Among the PNW pool of employees we sampled, 28 percent were scientists. Among all PNW scientists, 30 percent were women at the time of our survey; hence, the gender bias among scientists alone potentially contributes to a gender bias with pay grade at hiring. Third, race-ethnicity was related to the location where the respondent was living when they learned of their future PNW job (analysis f, $p = 0.014$) (table 3). Non-White employees were more likely to have been living in more urban locations when they learned of their first PNW job.

Although we did not find a significant pattern relating race-ethnicity and pay grade at hiring using logistic regression (analysis d, $p = 0.820$) (table 3), this result may stem from the smaller number of non-White workers in our sample. To explore potential trends further, we examined race-ethnicity by pay grade and factor (table 4), using the 4-factor positions to distinguish scientists within the sample population. Of the 34, 4-factor respondents (scientists), one was non-White (3 percent). This contrasts with the 13 percent of non-White employees in the overall respondent pool ($\chi^2 = 3.02$, $df = 1$, $p = 0.08$) and supports a trend for a race-ethnicity bias among the subsample of scientists at the research station. Lastly, there appeared to be a pattern of grade-equity between the White and non-White populations (table 4), with about 42 percent of sampled employees in each race-ethnicity group (White, non-White) being hired into pay grades $\geq$ GS-11. Although there was only one, 4-factor scientist who was non-White, there was a trend for 9-factor employees with pay grades $\geq$ GS-11 to be more often non-White (89 percent) than White (56 percent).

Table 4—Race-ethnicity by pay grade and performance factor, USDA Forest Service, Pacific Northwest Research Station

Race-ethnicity	Pay grade < GS-11		Pay grade $\geq$ GS-11	
	Factor 4	Factor 9	Factor 4	Factor 9
Number (percentage)				
Non-White	0	12 (100)	1 (11)	8 (89)
White	7 (7.5)	87 (92.5)	27 (44)	35 (56)

Note: Pay grade = GS-1 through GS-15; factor 4 = paneled scientist; factor 9 = professional, technical, or administrative staff; $n = 183$.

Discussion

In the American workforce, diversity issues appear to persist because of a complex set of factors including a constantly changing population and many employment inequities. Although the U.S. federal government workforce strives for justice and equality, this subpopulation of the entire U.S. workforce is not immune to demographic inequities, prompting several cultural transformation agendas within different government sectors. In our study examining the demographic patterns of employees of the USDA, Forest Service, Pacific Northwest Research Station in 2012–2014, we found that the workforce was predominantly male and tended to have more White than non-White employees relative to race-ethnicity. We also found demographic differences in how employees learned of their first PNW job. This new knowledge provides information that can benefit both unemployed persons seeking employment and PNW employers who are striving to be more inclusive. Although our study is exploratory with limited scope, it can inform a broader investigation of the social dynamics of job acquisition, which may lead to broader equity and inclusion of diverse social groups in federal employment at research institutions.

We found that males were more likely than females to have learned of their PNW job through nonsocial means. For this result and several others discussed below, we do not know why the pattern occurred—understanding that mechanism warrants a followup study. Nevertheless, it is important to recognize that this gender-based pattern could be an underlying, possibly inadvertent cause of employment patterns. To address this pattern, recruiters could use a combination of nonsocial and social employment outreach tactics to fill positions, and it would be prudent for unemployed persons to use both social and nonsocial means of jobseeking. Providing training on online job application processes might be an additional consideration. For example, recently, Yu (2018) reported that 41.4 percent of survey respondents were actively recruited into federal law enforcement jobs through personal recommendations, internships, and internal cross-functional hires; controlling for gender, more female respondents (53.7 percent) were actively recruited than male respondents (37.9 percent).

Additionally, we found that PNW employees hired into higher pay grades learned of their PNW job more often through nonsocial means. Again, without knowing why this result occurred, we can only speculate that higher pay grade, more technical or managerial positions may be filled through Web postings. Qualified applicants in these job applicant pools may also have better knowledge about nonsocial application procedures and are therefore more aware of job openings. Some of our respondents were already federal employees when PNW hired them, so they may have had some knowledge of job openings, perhaps from email list servers, for example. Nonsocial means of jobseeking, such as the

federal website usajobs.gov, were more common after 2000 than before that year, supporting the increased use of this method over time. Today, most applicants for federal jobs must submit applications through usajobs.gov even if they initially found out about the job in some other manner. Rein (2015) showed that employees who were already in government positions filled 70 percent of open federal jobs, and members of the general public filled the remaining 30 percent of job vacancies.

Our study results indicated that social capital may play a key role in employment prospects. Among employees who found out about their first PNW job from others (informants), those informants were most often coworkers or strangers. Coworker relationships appeared to support the success of jobseekers, and these ties seemed to enable jobseekers to leverage their employment status. A study by Saygin et al. (2014) highlighted the role of work-related networks in job information transmission. Their research showed that a job applicant who had a direct link to former coworkers was twice as likely to be hired by the connected firm than an applicant without a link. In addition, Glitz (2017) showed a strong positive effect of a higher employment rate in a worker's social network of former coworkers on the worker's reemployment probability after displacement. With coworkers being a key source of job information, it could benefit a jobseeker to take on internships or suboptimal jobs to gain entry to a workforce and become part of that social network for potential future employment. The developing pattern of learning of jobs from strangers is a novel result from our study. It is possible that outreach efforts such as at federal government kiosks at job fairs could contribute to such in-person communication between jobseekers and strangers; however, followup research is needed, as we did not identify how employees encountered strangers in our study. Although encounters with strangers have been described as weak links in social relationships (Granovetter 1973), they could be important in connecting jobseekers to jobs. Interestingly, our results contrast with some past studies that found that family and friends were important for linking jobseekers with employment opportunities (e.g., Pellizzari 2010, Rees 1966).

Intersections of race-ethnicity and gender were evident in our study. We found that White persons were more likely to have been informed about a job opportunity by males, and conversely, non-White persons were more likely to have been informed about a job by females. This race-ethnicity $\times$ gender intersectionality of social networking for job finding is curious and merits followup. Although our sample population was largely White and male, such that a larger sample size might reveal a different pattern, this finding suggests that there may be either demographic patterns in communication pathways or gender-based communication styles that cross race-ethnicity boundaries. For example, do non-White persons communicate less with men about job opportunities or do women offer more help to underserved communities—perhaps because they themselves are an underserved

community? More simply, could women employed as job outreach specialists attend PNW job fairs and face-to-face outreach activities that target non-White populations? In our relatively small sample of one research institution, a small number of women outreach specialists could potentially have that sort of influence over the course of their careers. That possibility also could explain the relatively high frequency of strangers as informants. If so, jobseekers may have an edge for employment by attending job outreach events.

We found that pay grade was a predictor of the gender of the person hired, with fewer women hired into higher pay grade jobs. It was surprising that this finding was even more significant in recent years despite a general perception that equal-opportunity employment strategies have successfully addressed gender inequities through decades of implementation. Our result could have stemmed from the gender bias among the scientist portion of the workforce. Research stations hire scientists with doctoral degrees into positions with pay grades $\geq$ GS-11, and only 30 percent of PNW scientists were women during our survey years. PNW employs scientists in a variety of disciplines including social, physical, and biological sciences, and interdisciplinary positions such as research foresters and research ecologists are common.

Our study supports other recent reports of gender bias in STEM fields. For example, Arismendi and Penaluna (2016) showed that women and minorities represented a small portion of tenure-track faculty and federal government professions in fisheries sciences; women occupied only 26 percent of federal fisheries scientist/manager positions and less than 30 percent of tenure-track professor positions, suggesting systemic biases. Arismendi and Penaluna (2016), also found that non-White fisheries scientists/managers occupied fewer than 12 percent of positions in federal agencies and tenure-track academic institutions. Although the research station hired only one non-White person into a scientist position among our surveyed employees, our sample sizes of both non-White persons and scientists were likely too small to detect a meaningful pattern among this demographic subset. However, our findings support an emerging race-ethnicity inequity by pay grade for nonscientist positions, with non-White employees tending to gain pay grade advantages; 89 percent of non-White employees in our sample were hired into higher grade, nonscientist jobs (versus 56 percent of White employees). Again, further study could examine why this pattern occurred, whether there was a bias in the applicant pool (e.g., from outreach only to underserved communities), if these types of positions have underlying demographic biases, or if another hiring process resulted in a workforce skewed in this direction. This topic raises the issue of how organizations may account for employment diversity. If we analyzed the entire organization, we might not detect biases by pay grade or job.

Non-White employees were more likely to have been living in urban areas when they learned of their first PNW job. One possibility could be that non-White employees have migrated from rural areas to urban areas in search of job opportunities and better social and economic opportunities (Saenz 2011). Further work would help determine if this was an actual geographic pattern of non-White employee residence or whether this resulted from a hiring process such as outreach activities at urban events. This may be a consideration if the inclusion of underserved communities in employment outreach is a priority.

In summary, our study shines light on a variety of gender and race-ethnicity inequities in both how employees learned of their jobs and what their resulting positions were at the federal organization we investigated. Addressing the underlying causes of the patterns we have detected requires further research. Also, we should note that our findings have inference only to our sampled population, the USDA Forest Service, Pacific Northwest Research Station. It would be interesting to compare these results with other Forest Service research stations or workforce sectors, especially those in geographic locations that may have more diverse state populations. Nevertheless, our case study detected several workforce patterns relative to race-ethnicity, gender, and use of social or nonsocial means of job finding. These patterns can be useful for jobseekers as they determine strategies to find jobs and for employers who may be addressing diversity and inclusion in their workforces, a current priority for federal employers seeking justice and equality for all Americans.

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