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Original Article

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Gendered Safety and Health Risks in the Construction Trades

Hannah M. Curtis[1,*], Hendrika Meischke[2], Bert Stover[2], Nancy J. Simcox[1], and Noah S. Seixas[1]

[1]Department of Environmental and Occupational Health Sciences, University of Washington, 4225 Roosevelt Way NE, Suite 100, Seattle, WA 98105, USA; [2]Department of Health Services, University of Washington, 1959 NE Pacific St Magnuson Health Sciences Center, Room H-680 Box 357660 Seattle, WA 98195, USA

*Author to whom correspondence should be addressed. E-mail: hmcurtis@uw.edu

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Abstract

Objectives: Despite women's increased representation in the overall workforce, construction remains a male-dominated industry. Prior studies have noted that the hazardous workplace environment combined with a culture that can be discriminatory and openly hostile can threaten women workers' health and safety. However, little information exists about the current physical and psychosocial hazards at work affecting tradeswomen.

Methods: We examined differences in workplace exposure between women and men, and the association of these exposures with self-reported stress and work injury, in order to highlight how gendered conditions of work negatively affect tradeswomen's health. A holistic view of health that included the influence of both home and work spheres as well as hazards related to women's social experience was considered. Almost 300 workers (198 tradeswomen and 93 tradesmen) throughout Washington State completed surveys. We used descriptive statistics to compare exposures between genders, and logistic regression to model the association between psychosocial exposures and injury and stress outcomes.

Results: We found that women were significantly more likely than men to report high perceived stress (31 and 18%, respectively) and being injured at work in the past year (31 and 12%, respectively). Ten of the 12 work-related psychosocial exposures were found to be associated with either stress (job strain, gender and age discrimination, bullying, work/life balance, isolation, sexual harassment, safety climate, and social support) or injury (gender discrimination, bullying, overcompensation, and sexual harassment) for women.

Conclusions: The industry continues to lag in supporting tradeswomen's health and safety needs. This study suggests that multiple exposures (including discrimination, overcompensation, and work/life balance) have an important impact on worker well-being. The findings underscore the complex interaction of gender, psychosocial exposures, and occupational risks, and indicate areas for intervention.

Keywords: construction trades; gender; occupational injury; occupational stress; psychosocial exposures

Introduction

There are well-documented hazards to construction worker safety and health. Fatal and non-fatal risks identified include slips, trips and falls (Bentley et al., 2006; BLS, 2015), electrocution (OSHA, 1999), musculoskeletal disorders from overexertion (Schneider, 2001), being struck by or caught in heavy machinery, and chronic health conditions from exposure to toxic chemicals (Ringen et al., 1995; OSHA, 1999; Welch et al., 2000; BLS, 2015). In addition to various physical and chemical hazards, organizational stressors from high job demands, insufficient support from coworkers or management, and discrimination also contribute to workers' illness and injury risk (Goldenhar et al., 2003; Boschman et al., 2013). Studies suggest that women workers face more risks related to organizational processes and a culture that can be discriminatory to openly hostile (OSHA, 1999; Moir et al., 2011).

Construction's male-dominated culture can threaten tradeswomen's physical safety and mental health. For instance, many tradeswomen note a lack of available personal protective equipment (PPE) designed for women's bodies (Ontario Women's Directorate, 2006; Onyebeke et al., 2016). As the last line of defense against occupational hazards, PPE is essential for construction workers' safety; however, women's underrepresentation on construction worksites creates a disincentive for employers to provide specialized PPE. Another challenge for women workers is a dearth of adequate sanitary facilities—bathrooms that are clean, available, accessible, and private—on most worksites (Goldenhar and Sweeney, 1996; Welch et al., 2000). Male-dominated industries have higher levels of interpersonal and institutional sexism than those that are more egalitarian or female-dominated, which negatively affects women workers (Fitzgerald et al., 1997; Bond et al., 2004). Women in the numerical minority also tend to report more stress, alienation, social isolation, and sexual harassment (Miner-Rubino and Cortina, 2004). While the form of sexual and general harassment has become less overt since the 1970s, it continues to pose a problem for many tradeswomen (Eisenberg, 1999; Moir et al., 2011). Studies report a range of inappropriate and, at times, dangerous behaviors experienced by tradeswomen (Goldenhar and Sweeney, 1996; OSHA, 1999; Denissen, 2010). These include sexual and sexist jokes, groping, pranks, and even assault. Subtle and outright discrimination due to social norms about who belongs in the trades can also add to women's distress at work (Goldenhar et al., 1998; Moir et al., 2011; Hegewisch and O'Farrell, 2015). These prior studies have noted discrimination against women leading to withholding of essential hands-on learning opportunities during their apprenticeship training, which can hinder women's ability to advance in the trades and put them at risk of injury. To combat beliefs about their weakness and prove their worth, some women overexert themselves physically (Goldenhar and Sweeney, 1996).

Women have made great strides in integrating into the American workforce; however, construction remains an almost entirely male-dominated industry. Only 3% of skilled trades workers in the USA are women, a percentage that has barely changed in almost 40 years (BLS, 2016). Opportunities for tradeswomen are growing as the country experiences infrastructure development and projected shortages of skilled labor (Menches and Abraham, 2007). Women who work in the industry recognize the financial and psychological benefits including relatively high wages and benefits, 'earn while you learn' training opportunities, and satisfaction from tangible skill application. Previous studies have documented the multiple barriers to success faced by women workers but not enough is known about current psychosocial health and safety hazards specific to tradeswomen.

Because of the segregated nature of work by gender (Hegewisch et al., 2010; Eng et al., 2011), evidence of gender inequalities in working conditions and health outcomes (Campos-Serna et al., 2013), and the influence that working in industries dominated by one gender can have on workers' well-being, it is important that occupational health researchers use 'gender-based' analyses. In construction, the gendered nature of the male-dominated workplace shapes women's exposures and their responses to occupational and psychosocial hazards.

In the present study, we measured physical and psychosocial exposures faced by women compared to men in the construction trades and assessed the response to these exposures by gender. We used a qualitative analysis of focus group data to inform the development of a survey instrument and implemented the survey in a sample of women and men construction workers, the results of which are reported here. The goals of this study were 2-fold: (i) to examine differences in workplace exposure between women and men in order to highlight how gendered conditions of work impact women's health and (ii) to investigate the association between psychosocial exposures and injury and stress outcomes for women and men in the trades.

Occupational and Psychosocial Stress Theories

According to Karasek's occupational strain models, workers with high job demands and low control experience higher levels of strain, which social support can ameliorate (Karasek and Theorell, 1990). Similar theories, including Demerouti and colleagues' (2001) job demands-resources model, suggest that efforts to cope with chronic job demands can result in workers overtaxing their energy reserves and eventually leading to psychological and physical injury (Dollard and McTernan, 2011). Goldenhar and colleagues (1998) explored the relationship between what they term 'job stressors,' acute psychological and physiological reactions to exposures, and illness for tradeswomen using the NIOSH Generic Job Stress Questionnaire (GJSQ). As minorities in a physically and mentally demanding occupation, tradeswomen risk strain, especially if they lack support from coworkers and supervisors. Social support, serving as a buffer between exposures and psychological distress, is important in the construction industry, where work is collaborative and interpersonal trust is tied to safety (Cohen and Wills, 1985).

For tradeswomen, stress also comes from their underrepresentation and experience with a hostile work environment. For instance, tokenism—the symbolic effort to include members of minority groups to give the appearance of workplace diversity—can cause increased visibility and social isolation for women in construction (Kanter, 1977). Understanding how women navigate the workplace culture given their token status, and the ensuing health effects of discriminatory treatment, is essential. Okechukwu and colleagues (2014) linked pathways between workplace injustice exposures (including work-related discrimination, harassment, and abuse), exposure to occupational hazards, and poor psychological and physical health. Their model, based on Krieger's ecosocial theory of disease distribution, describes workplace injustice as being influenced by broader structural and interpersonal inequity (Krieger, 1994; Krieger, 2001). Accounting for these forms of injustice allows occupational researchers to place workers' health and safety experiences within a social context that goes beyond the workplace.

Focusing on construction, Goldenhar et al. (2003) assessed the relationships between a broad set of work-related stressors and injury/near miss outcomes. Their findings show that psychosocial exposures such as discrimination and harassment indirectly relate to injury and near misses through physical symptoms and psychological strain, respectively, although they found no differences by gender in their models. In their earlier job stress model using female laborers, Goldenhar and colleagues (1998) found a positive association between sexual harassment and discrimination with negative psychological and physical symptoms. Other studies have shown that for women in male-dominated industries, sexual and other forms of harassment are more important than many of the occupational psychosocial exposures (i.e., psychological workload/demand and decision latitude/control) on workers' risk for illness and injury (Rospenda et al., 2005).

Methods

For this study, the researchers collaborated with a community group (Washington Women in Trades) and labor education center (Washington State Labor Education and Research Center) to investigate workplace hazards and their effects on women and men in the trades using a cross-sectional survey. The Washington State Institutional Review Board determined the project to be exempt from review due to the anonymity of responses.

Women and men currently working in the building and construction trades in Washington State were eligible to participate. The research team sent hard copy and electronic flyers with the survey link to contacts recommended by community committee members. Participating organizations included 34 unions, 22 apprenticeship programs, 9 trade associations, and 20 contractors throughout Washington State. Members of the research team also promoted the study on social media, at union meetings, apprenticeship classes, and contractor safety events. To receive the gift card incentive for completing the survey, participants had to provide their mailing address. Due to the sampling strategy, we do not know how many individuals who were contacted about the study chose not to participate.

Given time restrictions and not wanting to overburden participants, we used a subset of questions from existing scales. See Table SI within the online supplementary material (available at *Annals of Work Exposures and Health* online) for a copy of survey items with selected cut-points discussed in this paper. The full survey contained 137 questions and took ~30 min to complete online. For many items, the wording was adapted to address the unique nature of construction work. In order to be inclusive of all workers, we asked participants 'what is your gender identity?' which determined the question paths; women workers were asked slightly different questions on a few scales than those who identified as men. We pre-tested the survey with

three tradeswomen and two tradesmen and revised the survey based on their feedback.

We examined two primary health outcomes: injury in the past year and perceived stress. Our injury outcome was defined as one requiring first aid or medical attention, or resulting in time off work. For stress, we used a shortened version of the Perceived Stress Scale (Cohen et al., 1983), a widely used scale that measures the degree to which an individual perceives life situations as stressful. We dichotomized the stress scale at the 75th percentile of our responses.

The survey also examined 8 physical and 12 psychosocial exposures. We chose items based on previously demonstrated reliability and validity for this population (Goldenhar et al., 1998; Goldenhar et al., 2003). Traditional industrial hygiene constructs guided questions on physical exposures. These included questions about workers' exposure to occupational hazards—dust or fumes, chemicals/acids/solvents, high noise, traffic or moving vehicles, being struck by materials/tools/equipment, working at heights without barriers, and electric shocks—and fit of PPE to protect against those exposures (Neitzel et al., 2013). During analysis, we collapsed the physical hazard scales into binary variables by dichotomizing (more than half the time/always versus about half the time/never). We also modeled PPE fit due to its potential relevance to injury and stress.

For psychosocial exposures, we used the NIOSH GJSQ (Hurrell and McLaney, 1988) as the primary source for questions about job demands and job control due to its accessibility and use in similar studies. Following occupational theories of job strain, we combined job demands and job control into a single job strain variable using the 75th percentile for job demands and the 25th percentile for job control. We defined jobs as low strain (low demands, high control), high strain (high demands, low control), passive (low demands, low control), and active (high demands, high control) jobs.

The Quality of Work Life Questionnaire (NIOSH, 2010) was the primary source for questions about discrimination at work including discrimination based on gender, race, and age. Due to a small number of racial and ethnic minorities in our sample, we dropped race discrimination from our analyses.

We also added questions to address additional psychosocial exposures identified in the literature and our formative focus groups. These included worker experiences with bullying, sexual harassment, overcompensation, work/life balance, isolation, tokenism, safety climate, and social support. A single-item measure of bullying (Einarsen & Skogstad, 1996) gauged workers' experience. We used a modified version of the widely used Sexual Experiences Questionnaire (Form SEQ-W) to measure sexual harassment for women (Fitzgerald et al., 1995). The SEQ-W measures participants' subjective perceptions of sexual harassment in three categories: gender harassment, unwanted sexual attention, and sexual coercion.

Results from our preliminary focus groups indicated that physical overcompensation due to inadequate PPE or tools and the need to prove one's ability were primary issues of concern, so we added questions on these topics. Work/life balance was measured using three items from the NIOSH Quality of Work Life Questionnaire, which were combined by taking their average. Tradeswomen may face feelings of alienation and loneliness due to their minority status, and we measured this construct, labeled isolation, using a subscale of the Loneliness at Work Scale (Wright et al., 2006). Tokenism was discussed broadly in the literature and indirectly in our focus groups and we employed two questions on gender inequity climate from the Subjective Experiences of Tokenism instrument (Yoder, 1994) as adapted by King et al. (2010). Only women received these questions. To measure workplace safety climate, we used the management safety commitment and ability subscale of the English version of the Nordic Occupational Safety Climate Questionnaire (Kines et al., 2011). Our social support questions came from an adaptation of the GJSQ subset as used by Goldenhar and colleagues (1998) in their study on tradeswomen. We defined social support to include support from supervisors and female and male coworkers. All continuous variables above were dichotomized using the lowest 25th percentile (e.g., the 25% with the most negative responses) for analysis. Cut-points were determined based on the whole study group, and the numeric values are provided in Table SI within the online supplementary material (available as supplementary data at *Annals of Work Exposures and Health* online.).

Demographic characteristics and exposures were first compared between genders and tested using chi-square test of independence. To assess the relationship between potential risk factors and health outcomes (injury and perceived stress), logistic regression models were developed for women and men separately. We first fit a base model with demographic variables selected *a priori*: trade, career level (i.e., apprentice or journey), and age category (see Table SII within the online supplementary material, available as supplementary data at *Annals of Work Exposures and Health* online). We added psychosocial exposure and PPE fit variables one at a time to the base model. We report the odds ratios (ORs) and their

95% confidence intervals (CIs), as well as the *P* values. To consider evidence for differences between genders in response to exposures, we also fit models to the whole data set, with an interaction between gender and psychosocial exposure variables. In addition, we note where a significant association with an individual variable was observed despite the overall model having a $P > 0.05$.

Results

Nearly 300 workers (291) completed the survey, of which 198 (68%) were women. Descriptive results are given by gender in Table 1. Seventy-five percent of workers identified as White. We had a diverse sample of trade professions with the highest representation among laborers and electricians. Women in this sample were less likely to report Latino ethnicity, heterosexual sexuality, and more likely to report journey career levels than the men.

Table 2 presents workers' health outcomes and exposure to physical and psychosocial occupational health hazards by gender. More women reported high perceived stress (31%) than men (18%) ($P < 0.05$). Twenty-five percent of all participants experienced an injury at work in the past year, with women significantly more likely than men (31 and 12%, respectively) to report being injured at work ($P < 0.05$). Interestingly, injuries to women were apparently more severe than those for men, with 69% of women and 46% of men receiving emergency room or medical attention, and 93% of women versus 68% of men with injuries missing at least 1 day of work as a result (data not shown). Among those respondents who were injured, 9% of them did not report their injury to others on site. Among those, women were more likely than men to list fear of layoff as the reason for not reporting.

For physical exposures, over 50% of our participants identified working around several hazards—i.e., high noise, traffic or moving vehicles, and materials/tools/equipment that could strike them—greater than half of the time. Men had higher exposure to dust and welding fumes and working at heights of at least four feet without barriers, compared to women. Women reported higher exposure rates than men for working with chemicals, acids, and solvents. They were also more likely than men to report PPE not fitting them properly (31% versus 9%, respectively).

There was no difference in job strain observed between the genders. Women workers reported significantly more bullying and discrimination based on their gender than did men. Two psychosocial exposures (sexual harassment and tokenism) were only asked of the

Table 1. Participant demographics.

	Women ($n = 198$)	Men ($n = 93$)
	n (%)	*n* (%)
Trade*		
Carpenter	20 (10)	7 (8)
Electrician	46 (23)	16 (17)
Laborer	60 (31)	40 (43)
Pipe trades	21 (11)	18 (19)
Sheet metal worker	14 (7)	6 (6)
Other	35 (18)	6 (6)
Career level*		
Apprentice	73 (37)	52 (57)
Journey	125 (63)	40 (43)
Years in trades		
1–3	66 (34)	40 (43)
4–10	63 (32)	30 (32)
11+	68 (35)	23 (25)
Current union member		
Yes	174 (89)	85 (94)
Age range (yrs)		
<30	27 (14)	20 (23)
30–40	66 (35)	33 (38)
41–50	50 (26)	14 (16)
>50	48 (25)	20 (23)
Race		
White	154 (80)	65 (75)
Black or other	38 (20)	22 (25)
Ethnicity*		
Latino	15 (8)	14 (16)
Sexual orientation*		
Heterosexual/straight	155 (81)	84 (97)
Other	36 (19)	3 (3)
Marital status*		
Married	59 (31)	42 (46)
Single	66 (35)	39 (43)
Divorced/other	66 (35)	10 (11)
Formal schooling level*		
Less than or finished High School or GED	28 (14)	18 (20)
Finished Trade/ Vocational School	39 (20)	13 (14)
Some College	61 (31)	43 (48)
Finished College	68 (35)	16 (18)

Independent sample chi-square. For trade, 'Other' includes boilermaker, ironworker, mason, operating engineer, other, painter, pile driver, and welder; for Race, 'Black or other' includes Black or African American, Asian American, American Indian or Alaskan Native, Hawaiian/Pacific Islander, Multiracial, and other; for Sexual orientation, 'Other' includes lesbian, gay, or homosexual, bisexual, and other; for Martial status, 'Divorced or other' includes divorced, widowed, and domestic partnership.

*Women and men are significantly different at $P < 0.05$.

Table 2. Outcome and exposure variables by gender.

	Women (n = 198)	Men (n = 93)
	n (%)	n (%)
Outcomes		
Injury***		
Yes in past year	62 (31)	11 (12)
Perceived stress*		
High (<25th percentile)	62 (31)	16 (18)
Physical exposures		
PPE fit***		
Poor	51 (31)	8 (9)
Dust/fumes*		
>Half the time	66 (33)	41 (44)
Chemicals/acids/solvents		
>Half the time	30 (15)	8 (9)
High noise		
>Half the time	115 (58)	52 (56)
Traffic/moving vehicles		
>Half the time	102 (52)	43 (47)
Struck by materials/tools/equip.		
>Half the time	108 (55)	52 (57)
Heights without barriers*		
>Half the time	35 (18)	27 (29)
Electric shocks		
>Half the time	46 (23)	24 (26)
Psychosocial exposures		
Job strain		
Low strain	52 (26)	21 (23)
High strain	41 (21)	24 (26)
Passive	12 (6)	9 (10)
Active	92 (47)	38 (41)
Gender discrimination***		
Yes	79 (43)	4 (4)
Racial discrimination		
Yes	14 (7)	5 (5)
Age discrimination		
Yes	37 (19)	11 (12)
Bullying***		
Yes	76 (39)	15 (16)
Sexual harassment		
High (<25th percentile)	57 (30)	N/A
Overcompensation		
High (<25th percentile)	71 (36)	27 (29)
Work/life balance		
Poor (<25th percentile)	85 (43)	30 (33)
Isolation		
High (<25th percentile)	69 (35)	28 (31)
Tokenism		
High (<25th percentile)	42 (22)	N/A
Safety climate		
Low (<25th percentile)	49 (27)	14 (17)
Social support		
Low (<25th percentile)	40 (29)	11 (17)

Independent sample chi-square.
*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.
N/AQuestions not asked of men.

women in the sample. One in three women reported high levels of sexual harassment and slightly fewer reported high tokenism (i.e. feeling the need to represent all women due to their minority status, and subsequent lack of acceptance by the dominant group).

Table 3 shows the association of psychosocial work exposures with 'injury' for women and men using separate logistic regressions. Each model assessed the contribution of a single exposure to the base model (trade, career level, and age).

The odds of being injured at work in the past year were >2-fold higher for women who reported gender discrimination [OR: 2.71, 95% CI: 1.36, 5.39], bullying [OR: 2.28, 95% CI: 1.17, 4.46], or high levels of sexual harassment [OR: 2.13, 95% CI: 1.05, 4.31] compared to those not reporting these exposures. The odds of injury due to high levels of overcompensation were more than four times greater than for women who reported low overcompensation. Although poor PPE fit was greater for women than men (31% versus 9%), it was not strongly associated with injury risk. Among men, the odds of injury were six times greater for those who reported a low safety climate compared to men who reported a high safety climate. For women, however, safety climate was not a significant predictor of injury. Men who reported bullying had a similar OR for injury as women (2.44 versus 2.28), although this was not statistically significant for men, likely due to the smaller number of male participants. Men also had a non-significant elevated OR for the association between overcompensation and injury (2.29), while only the association for women (4.23) was statistically significant.

Table 4 describes the association of psychosocial exposures with high levels of 'stress'. For women, experiencing discrimination based on gender and age, bullying, high levels of sexual harassment and isolation, and poor work/life balance were each associated with

high perceived stress. High stress was also associated with job strain (high strain, passive or active jobs compared to low job strain). Reporting a high safety climate and receiving high levels of social support from their coworkers and supervisors were negatively associated with stress.

For men, reporting poor work/life balance had a 4-fold increased odds of reporting high levels of stress. Men reporting active job strain (high demands, high control) had similar odds of stress as women (2.91 versus 2.84), but the association was not statistically significant, likely due to the smaller sample size. None of the other psychosocial exposures was significantly related to high perceived stress for men.

Differences in the associations between psychosocial exposures and either injury or stress differed between women and men; however, they were not generally statistically significant when tested using an interaction term in a model with the combined data, and a variable for gender. For instance, high and passive job strain categories had a higher association with stress for women than men, although the interaction was not statistically significant. For age discrimination, women had a much higher association with stress than men, and this was statistically significant. Women had a higher association of poor work/life balance with stress than men, although again, this interaction was not statistically significant.

Discussion

This study looked at differences in workplace exposures by gender for construction workers in Washington State, with a focus on psychosocial exposures for women. We considered both differential levels of exposure between genders, and the differential responses to exposures because both levels of exposure and response may contribute to adverse health consequences for women or men. Using the survey data, we observed higher rates of injuries and stress for women compared to men. We also found strong associations with several psychosocial exposures (e.g., age discrimination, overcompensation, work/life balance, social support) for both injury and perceived stress outcomes, with generally higher, though not statistically different ORs for women.

The results for worker exposure to traditional occupational hazards are not surprising, given the dangerous environment of many construction worksites. Differences by gender in exposure to specific physical hazards could be attributable to gendered distribution of trades and tasks, or to variability in exposure reporting. Women reported a higher likelihood of physical injury at work compared to men. These findings differ from officially reported data; based on data from the Bureau of Labor Statistics (BLS, 2015, personal communication), we estimated somewhat higher rates of injuries with days away from work for men (86/10 000 workers) than women (50/10 000 workers) in construction. In a multi-industry study of workers in West Virginia, women in construction also had lower compensable work-related injuries and illnesses rates than men did, although when injury/illness groups were stratified by industry and occupational category, women had higher risk of specific injuries/illness compared to men (Islam et al., 2001). Our findings also suggest that the higher injury rates for women are not due to reporting bias with respect to the severity of the injury. If anything, our results based on days away from work, and seeking medical treatment, demonstrate that injuries experienced by women are at least as severe as those experienced by men.

Our findings on psychosocial exposures are consistent with a literature review showing unequal gender distribution of work-related exposures between women and men (Campos-Serna et al., 2013). Women's higher reporting of stress compared to men—and results showing that stress was more strongly associated with many of the psychosocial exposures (i.e. higher ORs) for women compared to men—indicates that stress is an important concern for tradeswomen and one that relates to the gendered patterning of the work. Anecdotal evidence and safety studies reveal that construction workplaces are rough environments built around masculine social norms that espouse competition and hazing (Goldenhar and Sweeney, 1996; Eisenberg, 1999). Women participants' experiences with bullying and gender discrimination reflect these norms and may also be linked to majority group perceptions of them as outsiders. The scarcity of women workers on many worksites means that men rely on sexist stereotypes when they first encounter a tradeswoman, and judge her based on past experiences or negative stories they have heard about women. However, less than one-quarter of women in our survey reported high levels of tokenism, and its unexpected (albeit not statistically significant) negative association with stress suggest that this construct may be less applicable to tradeswomen today than in the past. We observed a strong interaction between gender and age discrimination, with a nearly 10-fold increase in the odds of stress among women reporting age discrimination. This may reflect a gendered ageism (Duncan and Loretto, 2004); however, age discrimination was not clearly associated with age for women or men. Our findings that high overcompensation is strongly associated with risk of injury for

Table 3. Odds ratios for injury from logistic regression models for each psychosocial variable, and including the base model (trade, career level, and age).

Variable (reference category)	Injury (yes), OR [95% CI]	
	Women	Men
Psychosocial exposures		
Job strain (low strain)		
High strain	2.37 [0.75, 7.42]	3.44 [0.47, 25.43]
Passive	2.13 [0.88, 5.15]	3.34 [0.66, 16.92]
Active	1.03 [0.39, 2.72]	0.76 [0.06, 9.92]
Gender discrimination (no)		
Yes	2.71 [1.36, 5.39]**	[a]
Age discrimination (no)		
Yes	2.17 [0.97, 4.86]	[a]
Bullying (no)		
Yes	2.28 [1.17, 4.46]*†	2.44 [0.47, 12.78]
Overcompensation (low)		
High (<25th percentile)	4.23 [2.09, 8.56]***	2.29 [0.58, 9.09]
Work/life balance (good)		
Poor (<25th percentile)	1.45 [0.75, 2.81]	1.24 [0.34, 4.50]
Isolation (low)		
High (<25th percentile)	1.53 [0.79, 2.98]	0.52 [0.11, 2.40]
Sexual harassment (low)		
High (<25th percentile)	2.13 [1.05, 4.31]*†	[N/A]
Tokenism (low)		
High (<25th percentile)	1.21 [0.55, 2.65]	[N/A]
Safety climate (high)		
Low (<25th percentile)	1.64 [0.78, 3.45]	6.06 [1.29, 28.57]*†
Social support (high)		
Low (<25th percentile)	0.81 [0.32, 2.04]	[a]
PPE fit (good)[b]		
Poor (<25th percentile)	0.62 [0.30, 1.28]	1.09 [0.11, 11.25]

All models control for trade, career level, and age.

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; †Overall model $P > 0.05$.

[N/A]Questions not asked of men.

[a]Could not be estimated due to low frequency of positive responses.

[b]Because of its potential relevance to injury, we included PPE fit in this model, recognizing that it is not a true psychosocial exposure.

women align with those of other studies that demonstrate tradeswomen's constant need to prove themselves against these perceptions, which can result in physical overexertion (Goldenhar and Sweeney, 1996) and negative health outcomes (Goldenhar et al., 1998).

In addition to its influence on worker perceptions of sexism, the gender ratio on construction worksites can affect the prevalence of sexual harassment (Fitzgerald et al., 1997), as well as workers' response to these negative experiences. Our finding that sexual harassment is significantly associated with injury and stress is consistent with Goldenhar and colleagues' earlier work (1998) showing the exposure predicting psychological symptoms for women laborers, although they used a combined sexual harassment and discrimination variable. Unlike earlier studies suggesting that the majority of tradeswomen experience sexual harassment (Goldenhar and Sweeney, 1996; OSHA, 1999), less than one-third of our women participants reported high levels of the exposure. Variable findings on harassment may indicate improved treatment of women, or they may relate to reporting stigma or confusion around identifying harassing behaviors. Cultural norms in construction often encourage an informal response to harassment as a coping mechanism (Denissen, 2010). Other studies have revealed negative effects on all workers, not just women, who work in a hostile environment (Goldenhar et al., 2003; Miner-Rubino and Cortina, 2004; Okechukwu et al., 2014). Given sexual harassment's documented

Table 4. Odds ratios for perceived stress from logistic regression models for each psychosocial variable, and including the base model (trade, career level, and age).

Variable (reference category)	Stress (>2.2), OR [95% CI]	
	Women	Men
Psychosocial exposures		
Job strain (low strain)		
High strain	3.16 [0.98, 10.20]	1.14 [0.16, 8.16]
Passive	2.45 [0.97, 6.19]	0.97 [0.19, 5.02]
Active	2.84 [1.13, 7.11]*†	2.91 [0.59, 14.27]
Gender discrimination (no)		
Yes	2.46 [1.23, 4.93]*†	[a]
Age discrimination (no)		
Yes	9.77 [3.89, 24.53]***	1.33 [0.12, 14.83]
Bullying (no)		
Yes	2.43 [1.24, 4.78]**†	0.65 [0.11, 3.72]
Overcompensation (low)		
High (<25th percentile)	1.94 [0.99, 3.81]	1.40 [0.40, 4.93]
Work/life balance (good)		
Poor (<25th percentile)	7.78 [3.67, 16.47]***	4.70 [1.32, 16.71]*†
Isolation (low)		
High (<25th percentile)	2.08 [1.06, 4.07]*†	0.87 [0.22, 3.50]
Sexual harassment (low)		
High (<25th percentile)	2.40 [1.19, 4.81]*†	[N/A]
Tokenism (low)		
High (<25th percentile)	0.76 [0.33, 1.76]	[N/A]
Safety climate (high)		
Low (<25th percentile)	2.50 [1.16, 5.26]*†	1.45 [0.30, 7.09]
Social support (high)		
Low (<25th percentile)	4.00 [1.69, 10.00]**	1.32 [0.21, 8.40]
PPE fit (good)[b]		
Poor (<25th percentile)	0.93 [0.85, 1.99]	1.27 [0.12, 13.31]

All models control for trade, career level, and age.

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; †Overall model $P > 0.05$.

[N/A]Questions not asked of men.

[a]Could not be estimated due to low frequency of positive responses.

[b]Because of its potential relevance to injury, we included PPE fit in this model, recognizing that it is not a true psychosocial exposure.

association with negative physiological and psychological outcomes (Fitzgerald et al., 1997; Goldenhar et al., 1998; Bond et al., 2004), our findings reinforce the need for continuing attention and prevention.

Women and men commonly reported poor work/life balance (43%, 33%, respectively). Although both women and men also had a significantly elevated OR for the association between poor work/life balance and stress, the estimated OR for women was substantially higher than that for men. Even so, the difference in the association was not statistically significant when examined with an interaction model. The strong association between poor work/life balance and high perceived stress for all participants demonstrates the importance of examining relationships between paid and unpaid labor. When workers have a good balance between work and their home life, it can serve as a coping mechanism and moderate the impact of their job demands on potential stress. However, poor work/life balance can exacerbate work stress by increasing exposure to additional stressors and hindering recovery time. Knowing that women continue to bear a double burden for unpaid labor demands, future studies should further explore the impact of this exposure using a gendered lens.

Examining safety climate and social support helps us understand how certain aspects of construction culture can buffer the effect of work exposures on negative health outcomes. The majority of workers in this study reported

positive safety climates for which we found a strong negative association with stress. The increased risk for men reporting injury when they perceived low safety climate aligns with findings showing the construct as a strong predictor of physical safety outcomes (Chen, McCabe and Hyatt, 2017). Why low safety climate was associated with injury for men, and with stress for women, is curious and deserves further study. Men may rate management support lower if they have experienced an injury, while women may identify poor safety management as a cause of their stress. Our social support findings are consistent with other studies and theories that show how perceived social support could mitigate the effects of stress on individuals' psychological distress (Viswesvaran, Sanchez and Fisher, 1999; Cohen, 2004). Also in keeping with the literature, we found that the effects of low social support on stress were stronger for women compared to men. Other studies suggest that social support may more strongly align with health for women (Vermeulen and Mustard, 2000; Goldenhar et al., 2003), and that supervisor support is particularly important for women working in non-traditional occupations (McIlwee, 1982; Eisenberg, 1999).

This study has several limitations. First, participants self-selected into the survey based on a non-random sampling method. It is not clear whether the workers in our study are representative of the general US construction industry, since participants may have already had an interest in discussing women's workplace health and safety. Similarly, participants were currently working, meaning that there may be a survivor bias in the data. We did attempt to account for this by capturing the reasons women left the industry during the screening process: retired, disabled, and left due to 'hostile work environment.' All data are based on self-report and are cross-sectional, so cause and effect cannot be determined. Concern with positive information bias is particularly important in studies of occupational stress in which both the exposure to a stressor, and the perceived symptoms of stress are queried on the same day. While this cannot be avoided entirely in a cross-sectional survey, our questions for both psychosocial exposures and perceived stress outcomes were worded to avoid such biases (see Table SI within the online supplementary material, available as supplementary data at *Annals of Work Exposures and Health* online). In addition, the primary questions in this study of differential exposures or responses to stress between women and men would only be affected if the genders have different levels of bias in their responses.

The relatively small number of men in our sample limited our power to detect statistical significance well for that group. There was also an underrepresentation of non-white and non-union voices in our data, largely attributable to our recruitment methods. Other studies have shown that Black tradeswomen may experience greater danger and exposure to disrespect than white tradeswomen (Eisenberg, 1999; Berdahl and Moore, 2006; Hunte, 2012). Union members composed the vast majority (89%) of our sample, which reflects the challenge of reaching non-union workers. Unions play an important role in connecting women workers; women have a greater chance of enrolling in apprenticeships if unions are involved (Berik and Bilginsoy, 2002).

Many of the risks our study identified have affected tradeswomen for decades, demonstrating the industry's ongoing failure to provide a supportive workplace for women. It is important for occupational health researchers to include women as they study the impact of construction on worker well-being, and for apprenticeship programs, unions, and policy makers to improve opportunities for women to enter and succeed in the industry. Women in our study report many workplace exposures that relate directly to stress. Given the well-documented connection between stress and negative health outcomes, it is imperative to focus on stress on construction worksites as a strategy to improve worker well-being. The psychosocial exposures studied above, including discrimination, overcompensation, bullying, and harassment, can be a good starting place. Recommended strategies include stricter policies that prohibit discrimination in terms of training opportunities and hiring and promotion, and education that promotes respect and appreciation for diversity. Several companies and pre-apprenticeship programs in Washington State are now focusing on 'respectful workplace' training to eliminate the negative health effects from bullying and harassment. Given that almost half of women surveyed reported having a poor work/life balance, and how the exposure significantly increased risk for high stress for both women and men, focusing on policies related to this exposure and flexible, but predictable, scheduling around childcare could also have a positive impact on workers.

Supplementary Data

Supplementary data are available at *Annals of Work Exposures and Health* online.

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Conflict of Interest

The authors declare no conflict of interest relating to the material presented in this Article. Its contents, including any opinions and/or conclusions expressed, are solely those of the authors.

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