Are Workplace Psychosocial Factors Associated With Work-Related Injury in the US Workforce?

National Health Interview Survey, 2010

Yvonne Farnacio, MD, MPH, Michael E. Pratt, MD, MPH, Elizabeth G. Marshall, PhD, and Judith M. Graber, PhD

Introduction: Psychosocial hazards in the workplace may adversely impact occupational and general health, including injury risk. **Methods:** Among 16,417 adult workers in the 2010 National Health Interview Survey Occupational Health Supplement, weighted prevalence estimates were calculated for work-related injuries (WRI) and any injuries. The association between injury and psychosocial occupational hazards (job insecurity, work–family imbalance, hostile work environment) was assessed adjusting for sociodemographic and occupational factors. **Results:** WRI prevalence was 0.65% ($n = 99$); any injury prevalence was 2.46% ($n = 427$). In multivariable models job insecurity, work–family imbalance, and hostile work environment were each positively associated with WRI prevalence (odds ratio [OR]: 1.60, 95% CI: 0.97–2.65; OR: 1.69, 95% CI 0.96–2.89; and 2.01, 95% CI 0.94–4.33, respectively). **Conclusions:** Stressful working conditions may contribute to injuries. There is need for ongoing surveillance of occupational psychosocial risk factors and further study of their relationship with injury.

The incidence of nonfatal occupational injuries and illnesses in the United States declined steadily among workers of United States' private sector between 1990 and 2014, from 8.9 to 3.2 cases per 100 full-time equivalent (FTE).[1,2] This decline accompanied changes in occupational health and safety practices, such as increased identification of hazards and the institution of controls to mitigate dangers in the workplace. The financial crisis of 2007 to 2008, and on-going changes in the economy, may have also contributed to this decline, given the decreased employment in high injury risk industries, such as manufacturing and construction.[3] Although the traditional approach of occupational health and safety focuses on biological, chemical, and physical hazards, psychosocial factors have emerged as potential targets for prevention of workplace injury and illness.[4,5]

The relationship between psychosocial factors and occupational injury has been studied in specific working populations, including coal miners,[6] hospital personnel,[7] university employees,[8] construction workers,[9,10] kitchen workers,[11] and petrochemical workers.[12] Psychosocial factors examined included low decision latitude,[7,9,11] hostile work environment and low coworker or supervisor support,[8,9,11,12] psychological distress (ie, feelings of sadness, irritability, worry),[10,11] and satisfaction with family life.[6,11] Less is known about the general US working population, although one national survey found that both workplace and sexual harassment were significantly associated with occupational injury and illness.[13]

To frame the relationship between psychosocial factors and injuries and illnesses, the National Institute for Occupational Safety and Health (NIOSH), part of the Centers for Disease Control and Prevention (CDC), developed the "NIOSH Model of Job Stress." That model describes the interplay between stressful job conditions and individual or situational factors that can influence the risk of injury and illness.[4] Examples of stressful job conditions include: long hours, hectic tasks, poor interpersonal relationships, job insecurity, and poor opportunities for career advancement. Examples of individual-level or situational factors that might mitigate a stressful environment include: having a balanced work and family life and strong support system, possessing an inherently positive outlook, and the ability to remain calm under pressure.

In 2010, NIOSH sponsored a series of work-related questions in a supplement to the National Health Interview Survey (NHIS), called the Occupational Health Supplement (OHS). This OHS, conducted shortly after the start of the previously mentioned financial crisis, included questions on exposures to three negative psychosocial factors in the workplace: job-insecurity, work–family imbalance, and hostile work environment. The prevalence for these factors among the US adult working population was 31.7% for job insecurity, 16.3% for work–family imbalance, and 7.8% for hostile work environment.[14] Our study aim was to investigate whether these factors were associated with work-related injury (WRI) prevalence in this nationally representative sample of US working adults. Since other factors increase the risk of injury at both the individual level (eg, age, education level, prior work experience) and job level (eg, manual material handling, workshift, poor housekeeping, long work hours), we also assessed sociodemographic and work-related factors in this study.[15]

METHODS

Data Source and Sample Selection

The NHIS is a cross-sectional, population-based survey that has been conducted yearly since 1957 by the CDC's National Center for Health Statistics (NCHS). In-person household interviews are conducted among the civilian non-institutionalized US population under a multistage clustered sampling design that oversamples minorities. NHIS survey data are de-identified and publicly available online.[16,17] Core survey questions, that remain relatively consistent from year-to-year, collect information about respondents' health and health behaviors. Supplement questions have content that varies yearly. In 2010, the OHS was included respondents aged 18 and older. The corresponding adult response rate (60.8%) factored in both the overall household response rate (79.5%) and the sample

From the Environmental Occupational Health Sciences Institute-Clinical Research and Occupational Medicine (Dr Farnacio, Dr Pratt, Dr Graber); Departments of Epidemiology (Dr Marshall, Dr Graber), Environmental and Occupational Health (Dr Pratt), School of Public Health, Rutgers, The State University of New Jersey, New Jersey.

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Address correspondence to: Judith M. Graber, PhD, Environmental and Occupational Health Sciences Institute, Rutgers, The State University of New Jersey, 170 Frelinghuysen Road, 320, Piscataway, NJ 08854 (graber@eohsi.rutgers.edu).

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adult response rate (77.3%).[18] Of the 17,524 participating adults who were currently or recently employed (in the past 12 months), 16,417 were included in our analysis after excluding those with missing data on demographic, occupational psychosocial factors, or injury questions.

Measures

Work Related Injury and Any Injury

WRI was defined as (1) having at least one injury in the past 3 months for which the respondent sought medical attention and (2) the injury happened while "working at a paid job."[19,20] We defined any injury as an injury in the past 3 months for which the respondent sought medical attention regardless of where the injury occurred.

Psychosocial Occupational Exposures

Respondents who were either currently employed or had been employed in the past 12 months were asked about three psychosocial occupational exposures: job-insecurity, work–family imbalance, and hostile work environment.[21] Job-insecurity was considered present if the respondent answered "agree" or "strongly agree" to the following statement: "I am/was worried about becoming unemployed." Work–family imbalance was present if the respondent answered "disagree" or "strongly disagree" to: "It is/was easy for me to combine work with family responsibilities." A hostile work environment was defined by answering "yes" to the following statement: "during the past 12 months, were you threatened, bullied or harassed by anyone while you were on the job?" We also looked at the influence of having any one of these three psychosocial occupational exposures (compared with having none) on the prevalence of injury.

Sociodemographic Characteristics

Our assessment of prevalence and risk factors included the following sociodemographic factors: age (in four groups: 18–30; 31–40; 41–50; more than 51), race-ethnicity (non-Hispanic (NH) white; NH black; Hispanic; other), sex, marital status (married vs all others), educational level (less than high school (HS); HS graduate/equivalent; 2-year college degree; greater than a 4-year college degree), and health insurance (private, public, or none). In our initial analyses, we considered region of the country (northeast, north central/midwest, south, and west); it did not add to the findings, so we did not include it. We also assessed smoking status and alcohol use. We categorized smoking status into current, former, or never based upon responses to the questions, "Have you smoked at least 100 cigarettes in your life" and if yes, "Do you now smoke cigarettes every day, some days or not at all?" Drinking categories were based on the question "In your entire life, have you had at least 12 drinks of any type of alcoholic beverage?" followed by the questions about current drinking: "In the past year, how often did you drink any type of alcoholic beverage?" and, to specify current alcohol use, "In the past year, on those days that you drank alcoholic beverages, on the average, how many drinks did you have?" Alcoholic beverages are defined as "liquor such as whiskey or gin, beer, wine, wine coolers, and any other type of alcoholic beverage." We dichotomized alcohol use as current moderate/heavy drinker or not (moderate drinkers were defined as having more than three to seven drinks per week for women and more than three to 14 drinks per week for men; and heavy drinkers were defined as having more than 7 drinks per week for women and more than 14 drinks per week for men).

Work-Related factors: Industry and Occupation, Weekly Work Hours

We grouped the NCHS 22 occupational and 20 industry subcategories into three categories each (occupations: white collar, service; industries: blue collar office-based, non-office-based, and other) in order to have a sufficient sample size in each category (Supplemental Figure 1, http://links.lww.com/JOM/A356).[17,22] We identified the number of hours worked in the last week as a dichotomous variable based on the 40-hour work week (less than or equal to 40 hours and more than 40 hours) since extended work time is a recognized risk factor for injuries.[23,24]

Data Analysis

All analyses were conducted using SAS/STAT® software (SAS Inc, Cary, NC) survey procedures to account for the complex sample design (including the multistage stratified cluster sampling), nonresponse, and unequal probabilities of selection into the sample. We calculated the prevalence and 95% confidence intervals of WRI considering injury alone, and stratified by sociodemographic and employment characteristics and the three psychosocial risk factors.

Logistic regression models were used to assess associations between each of the psychosocial factors (hostile work environment, job insecurity, and work–family imbalance, and having more than or equal to one of these factors) and WRI or any injury, controlling for potentially confounding sociodemographic and work-related variables. Each of the four psychosocial exposure variables was assessed in different models. We included age, race-ethnicity, educational level, and insurance status in all models *a priori*. For each psychosocial exposure, we began the model variable selection process by adding the remaining sociodemographic variables, that is, marital status, smoking and alcohol use history, and assessed the contribution of each to the model fit. Model fit was assessed using the likelihood ratio test[25] and whether the retention of the variable changed the resulting odds ratio (OR) more than 10%. The selection process was continued by using the same selection process to assess the contribution of work-related variables (weekly work hours, industry group, and occupation group were added) to each model.

Human Subjects

This study was determined to be exempt from review by the Rutgers, The State University of New Jersey, Biomedical and Health Sciences Institutional Review Board.

RESULTS

Subject Characteristics

Among the 427 respondents with any injury in the last 3 months (2.46%, 95% CI 2.17, 2.74), 99 injuries (0.65%, 95% CI 0.49, 0.82) were work related (Table 1). Job insecurity was reported by a third of the population (33.20, 95% CI: 32.33, 34.08) and was the most commonly reported of the three occupational psychosocial conditions. More than a third of the working population (37.14%, 95% CI 36.20, 38.08) reported at least one of the three factors.

Work Related Injury and Any Injury

The prevalence of WRI was significantly higher among respondents with a high school degree (0.89%) compared with those with a bachelor's degree or higher (0.42%). This pattern was not seen with any injury (Table 2). WRI was higher among men (0.77%) compared with women (0.51%), current moderate or heavy drinkers compared with non- or light-drinkers (0.88% vs 0.57%), current smokers compared with non-smokers (0.82% vs 0.55%), and those who worked more than 40 hours a week compared with those who worked a standard 40-hour work week or less (0.81% vs 0.63%). Similar patterns were seen for any injury.

Having a hostile workplace was positively associated with WRI and positive and significantly associated with any injury (Table 3). The association with any injury remained significant after adjusting for socio-demographic and occupational factors,

TABLE 1. Characteristics of US Adult Workers*; National Health Interview Survey (NHIS) and Occupational Health Supplement, 2010

Characteristic	*n*	Weighted %	(95% CI)
Total	16,417	100	
Work-related injury†			
Yes	99	0.65	(0.49, 0.82)
No	16,318	99.35	
Any injury‡			
Yes	427	2.46	(2.17, 2.74)
No	15,990	97.54	
Sex			
Male	7,949	52.33	(51.38, 53.28)
Female	8,468	47.67	(46.72, 48.62)
Age (yrs)			
18–30	4,299	27.80	(26.83, 28.78)
31–40	3,863	21.47	(20.67, 22.26)
41–50	3,712	23.59	(22.77, 24.41)
>51	4,543	27.13	(26.29, 27.98)
Race/ethnicity			
Non-Hispanic (NH) white	9,378	68.43	(67.35, 69.51)
NH black	2,388	10.69	(10.00, 11.38)
Other	1,361	6.42	(5.93, 6.91)
Hispanic	3,290	14.46	(13.71, 15.21)
Insurance			
Private	11,659	74.47	(73.51, 75.44)
Public	1,215	6.18	(5.73, 6.62)
Uninsured	3,543	19.35	(18.53, 20.17)
Marital status			
Married	7,626	55.99	(54.89, 57.09)
Divorced, separated or widowed	3,538	15.35	(14.75, 15.95)
Never married	5,253	28.66	(27.70, 29.62)
Education			
<High school (HS)	1,927	9.87	(9.27, 10.47)
HS graduate/equivalent	7,305	45.17	(44.18, 46.16)
2-year college degree	1,873	11.60	(10.99, 12.21)
≥4-year college degree	5,312	33.36	(32.32, 34.41)
Smoking history			
Never	10,213	61.24	(60.29, 62.19)
Current	3,235	19.79	(19.00, 20.58)
Former	2,969	18.97	(18.22, 19.72)
Current mod. or heavy drinker§			
Yes	3,689	23.39	(22.47, 24.32)
No	12,728	76.61	(75.68, 77.53)
Geographical region			
Northeast	2,539	17.55	(16.51, 18.58)
North Central/Midwest	3,736	24.07	(22.88, 25.26)
South	5,962	34.72	(33.40, 36.05)
West	4,180	23.66	(22.48, 24.84)
Weekly work hours‖			
11–20	1,112	8.30	(7.68, 8.93)
21–39	2,821	19.38	(18.5, 20.26)
40	6,281	43.12	(42.13, 44.11)
41–48	1,254	9.18	(8.58, 9.78)
>48	2,752	20.02	(19.19, 20.85)
Hostile work environment¶			
Yes	1,343	7.88	(7.33, 8.42)
No	15,074	92.12	(91.58, 92.67)
Job insecurity#			
Yes	5,784	33.20	(32.33, 34.08)
No	10,633	66.80	(65.92, 67.67)
Work–family imbalance**			
Yes	2,800	16.64	(15.96, 17.33)
No	13,617	83.36	(82.67, 84.04)
Number of occupational psychosocial factors			
0 out of 3	9,988	62.86	(61.92, 63.80)
≥1 of 3	6,429	37.14	(36.20, 38.08)

CI, confidence interval.

*NHIS sample adults who reported current or recent employment in the past 12 months.

†"Work-related injury" defined as reporting at least one injury requiring medical attention in the past 3 months that happened while at work.

‡"Any injury" defined as reporting at least one injury requiring medical attention in the past 3 months, regardless of where it occurred.

§Moderate drinking was defined as current use of more than three to seven drinks per week for women and more than three to 14 drinks per week for men. Heavy drinking was defined as current use of more than seven drinks per week for women and more than 14 drinks per week for men.

‖Work hours was only asked for current workers; 2197 respondents were missing for weekly work hours.

¶Hostile work environment was defined as answering yes to "During the past 12 months, were you threatened, bullied, or harassed by anyone while you were on the job?".

#Job insecurity was defined as answering "agree" or "strongly agree" to the statement "I [am/was] worried about becoming unemployed."

**Work–family imbalance was defined as answering "disagree" or "strongly disagree" to the statement: "It [is/was] easy for me to combine work with family responsibilities."

TABLE 2. Work-Related Injury and Any Injury Among US Adult Workers by Demographic, Occupational, and Health Behavior Characteristics; National Health Interview Survey (NHIS), Occupational Health Supplement ($n = 16,417$)*

	Work-Related Injury†				Any Injury‡			
Characteristics	***n***	**% (95% CI)**	**OR**	**95% CI**	***n***	**% (95% CI)**	**OR**	**95% CI**
All	99	0.65 (0.49, 0.82)			427	2.46 (2.17, 2.74)		
Sex								
Male	51	0.77 (0.50, 1.04)	1.52	(0.93, 2.49)	210	2.61 (2.17, 3.05)	1.14	(0.89, 1.46)
Female	48	0.51 (0.33, 0.68)	Ref		217	2.30 (1.91, 2.68)	Ref	
Age (yrs)								
18–33	31	0.66 (0.34, 0.97)	Ref		140	2.35 (1.85, 2.84)	Ref	
34–45	33	0.76 (0.44, 1.08)	1.15	(0.60, 2.21)	115	2.43 (1.86, 3.00)	1.04	(0.75, 1.44)
>45	35	0.56 (0.35, 0.76)	0.85	(0.47, 1.54)	172	2.79 (2.15, 3.00)	1.10	(0.85, 1.44)
Race/Ethnicity								
NH white	64	0.66 (0.46, 0.86)	Ref		280	2.69 (2.31, 3.07)	Ref	
Other	35	0.63 (0.35, 0.91)	0.95	(0.55, 1.64)	147	1.96 (1.56, 2.37)	0.73	(0.56, 0.94)
Insurance								
Insured	79	0.64 (0.46, 0.81)	Ref		354	2.58 (2.25, 2.92)	Ref	
Uninsured	20	0.71 (0.28, 1.14)	1.12	(0.57, 2.18)	73	1.95 (1.38, 2.52)	0.75	(0.54, 1.05)
Marital status								
Married	42	0.56 (0.37, 0.76)	Ref		159	2.04 (1.67, 2.41)	Ref	
Other	30	0.82 (0.46, 1.17)	1.46	(0.84, 2.53)	125	3.64 (2.80, 4.47)	1.82	(1.35, 2.44)
Never married	27	0.71 (0.34, 1.07)	1.27	(0.68, 2.38)	143	2.65 (2.07, 3.24)	1.31	(0.97, 1.78)
Education								
<High School	8	0.33 (0.14, 0.53)	0.8	(0.36, 1.80)	35	1.75 (0.84, 2.67)	0.77	(0.44, 1.34)
HS grad./equivalent	60	0.89 (0.59, 1.19)	2.12	(1.12, 4.03)	203	2.63 (2.18, 3.09)	1.16	(0.89, 1.51)
2-yr. college degree	11	0.58 (0.22, 0.95)	1.37	(0.59, 3.20)	55	2.89 (1.86, 3.90)	1.27	(0.85, 1.89)
≥4-yr. college degree	20	0.42 (0.19, 0.66)	Ref		134	2.28 (1.85, 2.71)	Ref	
Smoking history								
Never	53	0.55 (0.36, 0.73)	Ref		237	2.21 (1.86, 2.56)	Ref	
Current	25	0.82 (0.46, 1.17)	1.50	(0.87, 2.58)	101	2.84 (2.19, 3.48)	1.30	(0.98, 1.71)
Former	21	0.79 (0.34, 1.24)	1.44	(0.73, 2.85)	89	2.88 (2.16, 3.60)	1.31	(0.96, 1.79)
Mod/heavy drinker§								
Yes	28	0.88 (0.46, 1.30)	1.54	(0.88, 2.69)	294	2.16 (1.87, 2.45)	1.61	(1.27, 2.06)
No	71	0.57 (0.40, 0.74)	Ref		133	3.44 (2.75, 4.13)		
Weekly work hours‖								
≤40	60	0.63 (0.43, 0.83)	Ref		231	2.21 (1.89, 2.54)	Ref	
>40	31	0.81 (0.45, 1.17)	1.29	(0.76, 2.21)	123	2.78 (2.20, 3.35)	1.26	(0.98, 1.62)

CI, confidence interval; OR, odds ratio.

*All estimates account for the complex survey sample design.

†"Work-related injury" was defined as at least one reported injury for which medical attention was sought and occurred while working at a paid job within the past 3 months.

‡"Any injury" was defined as at least one reported injury for which medical attention was sought and occurred within the past 3 months.

§Moderate drinking was defined as current use of more than three to seven drinks per week for women and more than three to 14 drinks per week for men. Heavy drinking was defined as current use of more than seven drinks per week for women and more than 14 drinks per week for men.

‖Weekly work hours were available only for currently employed workers.

TABLE 3. Work-Related Injury and Any Injury Among US Adult Workers ($N = 16,417$),* by Occupational Psychosocial Factor, National Health Interview Survey (NHIS), Occupational Health Supplement, 2010

Occupational	Work-Related Injury*		Any Injury†	
Psychosocial Factor	***n***	**% (95% CI)**	**n**	**% (95% CI)**
Hostile work environment‡				
Yes	14	1.18 (0.40, 1.96)	64	2.29 (2.00, 2.59)
No	85	0.60 (0.44, 0.77)	363	4.38 (3.12, 5.64)
Job insecurity§				
Yes	43	0.82 (0.52, 1.12)	153	2.39 (2.02, 2.75)
No	56	0.56 (0.38, 0.75)	274	2.60 (2.13, 3.08)
Work–family imbalance‖				
Yes	28	0.93 (0.52, 1.34)	81	2.39 (1.80, 2.98)
No	71	0.59 (0.41, 0.77)	346	2.47 (2.17, 2.78)
Number of occupational psychosocial factors				
None of 3	49	0.51 (0.33, 0.68)	242	2.24 (1.87, 2.60)
≥1 of 3	50	0.88 (0.58, 1.18)	185	2.83 (2.39, 3.27)

CI, confidence interval.

*All estimates account for the complex survey sample design; Work related injury was defined as at least one reported injury for which medical attention was sought and occurred while working at a paid job within the past 3 months.

†Any injury was defined as at least one reported injury for which medical attention was sought and occurred within the past 3 months.

‡Hostile work environment was defined as answering yes to "During the past 12 months, were you threatened, bullied, or harassed by anyone while you were on the job?".

§Job insecurity was defined as answering "agree" or "strongly agree" to the statement "I [am/was] worried about becoming unemployed."

‖Work–family imbalance was defined as answering "disagree" or "strongly disagree" to the statement: "It [is/was] easy for me to combine work with family responsibilities."

TABLE 4. Prevalence Odds Ratios and 95% Confidence Intervals, Estimated from Logistic Regression Models of the Association Between Work-Related Injury and Any Injury With Adverse Psychosocial Work Factors Among US Working Adults ($n = 16{,}417$); National Health Interview Survey (NHIS), Occupational Health Supplement, 2010

	Work-Related Injury[*,†]			Any Injury[*,†]		
	Model 1 OR (95% CI)	Model 2[‡] OR (95% CI)	Model 3[§] OR (95% CI)	Model 1 OR (95% CI)	Model 2[‡] OR (95% CI)	Model 3[§] OR (95% CI)
Psychosocial factor						
Hostile work environment (Ref. = no)	1.99 (0.91, 4.35)	2.00 (0.93, 4.33)	2.01 (0.94, 4.28)	2.03 (1.40, 2.95)	2.05 (1.41, 2.99)	2.04 (1.41, 2.94)
Job insecurity (Ref. = no)	1.69 (1.03, 2.79)	1.67 (1.00, 2.80)	1.60 (0.97, 2.63)	1.12 (0.85, 1.47)	1.20 (0.91, 1.57)	1.19 (0.91, 1.57)
Work–family imbalance (Ref. = no)	1.71 (0.98, 2.96)	1.75 (1.01, 3.02)	1.69 (0.96, 2.98)	1.04 (0.77, 1.41)	1.06 (0.79, 1.44)	1.04 (0.77, 1.42)
≥1 of 3 occupational psychosocial factors (Ref. = none)	2.07 (1.25, 3.42)	2.05 (1.22, 3.45)	1.97 (1.18, 3.30)	1.32 (1.03, 1.70)	1.41 (1.10, 1.81)	1.40 (1.10, 1.80)
Socio-demographic factors[†,‡]						
Sex						
Female		Ref.	Ref.		Ref.	Ref.
Male		1.32 (0.80, 2.20)	1.02 (0.55, 1.89)		1.13 (0.86, 1.49)	1.08 (0.81, 1.43)
Age group						
18–30		Ref.	Ref.		Ref.	Ref.
31–40		0.95 (0.44, 2.02)	0.92 (0.44, 1.95)		1.16 (0.75, 1.79)	1.15 (0.74, 1.78)
41–50		0.84 (0.40, 1.77)	0.79 (0.37, 1.69)		0.92 (0.62, 1.36)	0.91 (0.61, 1.35)
>51 yrs		0.78 (0.38, 1.61)	0.76 (0.37, 1.57)		1.16 (0.79, 1.71)	1.16 (0.78, 1.72)
Race/ethnicity						
Non-Hispanic white		Ref.	Ref.		Ref.	Ref.
Other		0.82 (0.44, 1.52)	0.79 (0.42, 1.50)		0.71 (0.53, 0.95)	0.71 (0.53, 0.96)
Insurance						
Insured		Ref.	Ref.		Ref.	Ref.
Uninsured		0.92 (0.44, 1.92)	0.81 (0.39, 1.72)		0.76 (0.51, 1.12)	0.74 (0.50, 1.10)
Current mod./heavy drinker						
No		Ref.	Ref.		Ref.	Ref.
Yes		1.31 (0.75, 2.31)	1.30 (0.74, 2.30)		1.48 (1.13, 1.93)	1.47 (1.13, 1.92)
Educational level						
≥4-yr. college degree		Ref.	Ref.		Ref.	Ref.
2-yr. college degree		1.17 (0.49, 2.77)	0.84 (0.33, 2.15)		1.35 (0.87, 2.11)	1.29 (0.81, 2.04)
≤HS grad./equivalent		1.72 (0.92, 3.19)	1.15 (0.55, 2.39)		1.16 (0.88, 1.52)	1.09 (0.80, 1.50)
Work-related factors[†,§]						
Weekly work hours						
≤40 hours			Ref.			Ref.
>40 hours			1.31 (0.73, 2.34)			1.17 (0.90, 1.51)
Occupation						
White collar			Ref.			Ref.
Service			1.91 (0.90, 4.06)			1.12 (0.75, 1.66)
Blue collar			3.17 (1.41, 7.13)			1.33 (0.89, 1.97)
Industry						
Office based			Ref.			Ref.
Non-office based			1.09 (0.52, 2.28)			0.91 (0.62, 1.32)
Other			1.46 (0.70, 3.03)			1.08 (0.76, 1.53)

CI, confidence interval; OR, odds ratio.

[*]All models accounted for NHIS complex survey sample design.

[†]Each of the four psychosocial exposures was assessed in different models. Estimates shown for covariates (socio-demographic factors and work-related factors) are from models in which the exposure was more than or equal to one of three occupational psychosocial factors.

[‡]Model 2 adjusts for socio-demographic factors of sex, age group, race/ethnicity, insurance, current moderate/heavy alcohol use, and educational attainment.

[§]Model 3 adjusts for the socio-demographic factors in model 2 and additionally includes these work-related factors: weekly work hours, occupation group, and industry group.

including occupation and industry (2.04, 95% CI 1.41, 2.94; Table 4), whereas the association with WRI was of similar magnitude but of borderline significance (2.01, 95% CI 0.94, 4.28). The significant association between job insecurity and WRI remained positive and borderline significant after adjusting for socio-demographic and occupational factors (OR: 1.60, 95% CI 0.97, 2.63), as did balancing work–family responsibilities (1.69, 95% CI 0.96, 2.98). In contrast, any injury was not significantly associated with either job insecurity or imbalance in work–family responsibilities (OR: 1.19, 95% CI 0.91, 1.57 and OR: 1.04, 95% CI 0.77, 1.42, respectively). Reporting at least one or more of the three psychosocial occupational exposures was significantly associated with both WRI and any injury in the fully adjusted models (OR: 1.97, 95% CI 1.18, 3.30, and OR: 1.40, 95% CI 1.10, 1.80, respectively).

Work-Related Injury by Occupation and Industry Categories

The prevalence of WRI among blue collar and service occupation workers was significantly higher than that of white collar workers after adjusting for socio-demographic and workplace

TABLE 5. Prevalence Odds Ratios and 95% Confidence Intervals for Work-Related Injuries* Among US Adult Workers Who Worked in the Past 12 Months ($n = 16,417$), by Occupational and Industry Category†, NHIS, 2010

	n	% (95% CI)	Crude OR (95% CI)	Adjusted OR‡ (95% CI)†
Occupation				
White collar	39	0.35 (0.22, 0.48)	Ref.	Ref.
Service	23	0.88 (0.45, 1.31)	2.22 (1.18, 4.20)	2.27 (1.16, 4.43)
Blue collar	37	1.28 (0.74, 1.81)	3.40 (1.92, 6.02)	3.17 (1.59, 6.32)
Industry				
Office-based	27	0.41 (0.24, 0.57)	Ref.	Ref.
Non-office-based	32	0.94 (0.53, 1.35)	2.09 (1.12, 3.90)	1.75 (0.93, 3.29)
Other	40	0.69 (0.42, 0.96)	1.56 (0.86, 2.84)	1.76 (0.91, 3.38)

CI, confidence interval; OR, odds ratio.

*All results accounted for the complex survey sample design. Work related injury as defined as at least one reported injury occurring while working at a paid job within the past 3 months.

†Industries and occupation category groupings are those used by Kaur et al,[17] with the exception that farming, fishing, and forestry were included in the blue-collar occupation category.

‡Adjusted for age, sex, race/ethnicity, insurance, alcohol use, educational attainment, and at least one occupational psychosocial factor (job insecurity, work–family imbalance, or hostile work environment).

factors (OR: 3.17, 95% CI 1.59, 6.23 and OR: 2.27, 95% CI 1.16, 4.43, respectively; Table 5). Non-office based workers had higher odds of WRI compared with office-based industries, but this association was not significant after adjusting for possible confounders (OR: 1.75, 95% CI 0.93, 3.29).

DISCUSSION

This study examined whether psychosocial occupational exposures were associated with work-related injuries and found that of the occupational psychosocial factors assessed—hostile work environment, job-insecurity, and work–family imbalance—all were positively associated with work-related injury. Moreover, a hostile work environment was significantly associated with any injury. These findings suggest that workers' health may be improved by addressing any psychosocial hazards in the work environment. Prior research suggests that compared with other job stressors, workplace harassment may be a stronger predictor of workplace injury. Our findings expand upon this and suggest that workplace harassment may increase the risk of any injury—even outside the work environment. Workplace harassment may be an amenable target for intervention since it stems from interpersonal conflict.[8,13]

The overall prevalence of WRI was low, 0.65% (95% CI 0.49, 0.82). Other studies using the same NHIS data reported WRI prevalence for 2010 as 0.71%.[20,26] We excluded cases with missing information on key variables, hence the difference. These other studies reported that the lowest injury rate from 2004 through 2012 occurred during 2010, the year of the NIOSH OHS. A decline in WRI during the economic downturn has also been reported. It has been hypothesized that the WRI decline resulted from the reduction of new hires and reliance on experienced, less injury-prone workers; a disproportionate reduction of workers in hazardous occupations; and/or decreased job demands and work pace.[27,28]

Each of the three adverse psychosocial factors, alone or in combination, were positively associated with WRI after adjustment for sociodemographic and workplace characteristics. However, hostile work environment was the only factor significantly associated with any injury (Table 4). The relationships between WRI and work–family imbalance and job-insecurity were attenuated after adjusting for work-related factors, although their point estimates remained similar. Industries and occupations with employees engaged in manual labor had higher odds of work-related injury compared with office-based employment (Table 5). We hypothesized that WRI may vary by occupation, given varied stress, stressors, and safety cultures. However, the odds of injury for occupation and industry groups were similar when psychosocial and other sociodemographic variables were taken into account (Table 5). One possible explanation for the lack of association is that our broad groupings of industry and occupation were insensitive to any variation.

It has been almost two decades since NIOSH introduced its model depicting how psychosocial work factors and job stress may impact injury and illness in the work environment.[4] Since then, many occupation- and industry-specific investigations of the association between psychological stressors at work and WRI and illnesses have been conducted.[6–8,10–12,29,30] Future studies are needed to assess the role of these stressors at the population level. The relationship between some of these factors—including work-related sleep deprivation, fatigue, and work performance—has been well established.[31] In a study of Japanese food-processing plant workers, those with higher perceived job-insecurity were found to have less safety motivation and safety compliance and more reported injuries.[30] A prospective study in Polish workers found some repetitive strain injuries were statistically associated with high job demands and poor decision latitude; no significant relationship was observed between repetitive strain injuries and job insecurity or social support.[32] We have found a paucity of research regarding other factors such as work–family imbalance.

One strength of our study is that the use of a large nationally representative sample allows our findings to be generalizable to the US population. As such, our findings add to the existing literature supporting the associations between psychosocial factors and occupational injuries across the US workforce. To our knowledge, this is the first study to use NHIS data to explore this relationship. We are aware of only one other study (a random-digit dialed telephone survey) that examined work-related psychosocial factors with WRIs on a large, representative US population sample.[13] Consistent with our findings, that study reported significant positive associations between occupational injuries, illnesses, and assaults with workplace harassment (OR = 1.53; CI: 1.33, 1.75) and job pressure/threat (OR = 1.26; CI = 1.10, 1.45).

Our findings have several limitations including the low prevalence of WRI and any injury in the last 3 months. This may, in part, be attributable to underreporting and/or to participation biases. A significant proportion of workplace injuries are underreported by employers.[33] However, the NHIS data are self-reported and the degree to which individuals may seek health care without knowing or reporting that they are work-related is less well understood. Health care seeking behaviors for WRI are likely influenced

by many factors including health insurance coverage,[34] injury severity, individual demographics (eg, age, sex)[35] and immigration status.[36] Although the Affordable Care Act (ACA) was signed into law in the US March 2010—while this survey was underway—it was not fully implemented until January 1, 2014. Therefore, the ACA seems unlikely to have influenced health seeking behaviors at that time. Workers' compensation insurance may have had more impact on health seeking behavior during the survey. In the United States, this coverage varies considerably from state to state.[37]

Since the 2010 NHIS was conducted during a global financial crisis, this may limit the generalizability of the findings to more economically stable times. It is premature to conclude that the economic climate influenced the relationship between psychosocial hazards and work-related injury based on our cross-sectional study.

In order to obtain sufficient sample size to analyze industry groups, we collapsed office and non-office based industries and did the same for occupational groups. This tradeoff resulted in a loss of detail and may impact future comparability with other studies. Another potential limitation is that we were unable to assess multiple events per person since there were only two individuals who reported more than one work-related injury. The psychosocial factors were assessed by asking one question about each factor. In other studies, these factors have been captured using more detailed scales and questionnaires, such as the 24-item Work Harassment Scale and the 4-item Job Insecurity Scale.[38–40] Whether the use of a single question to capture these constructs introduced measurement bias, and the extent to which any such bias may have resulted in outcome misclassification, is unknown. Finally, the cross-sectional design of this study limits our ability to draw conclusions about causation. For example, it is feasible that an individual with a recent work-related injury could experience feelings of inadequacy performing job-related tasks, which could then lead to feelings of job insecurity. As well, a hostile work environment might actually be a mediator between some other factor and injuries, rather than as a main effect. Job stress may act as a predictor (eg, stressor in the environment), an outcome (eg, job strain), or as a mediator (eg, social support in the workplace). Also at issue, and as noted by Johnston in her literature review of studies that qualitatively assessed the relationship between occupational injury and stress, there is little homogeneity in literature regarding the definition or measurement of job stress.[41]

Whatever the manner of the association, the high prevalence of these adverse psychosocial factors among US workers points to the need for ongoing monitoring of these factors and study of their relationship with injury. The OHS should be regularly included in the NHIS and leveraged to better assess the prevalence and predictors of these adverse psychosocial factors and their relationship to injury.

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