HHS Public Access

Author manuscript

Am J Ind Med. Author manuscript; available in PMC 2015 August 04.

Published in final edited form as:

Am J Ind Med. 2012 May ; 55(5): 429–439. doi:10.1002/ajim.22031.

Cigarette Smoking in Building Trades Workers: The Impact of Work Environment

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Abstract

Background—Blue-collar workers smoke at higher rates than white-collar workers and the general population. Occupational factors may contribute to smoking behavior in this group. However, little is known about the role of occupational factors in explaining cigarette smoking patterns.

Methods—This study used cross-sectional data from the MassBUILT smoking cessation intervention study. Multivariable logistic regression analysis was conducted to investigate the association of occupational factors with current cigarette smoking among 1,817 building trades workers.

Results—Current cigarette smoking was significantly associated with the following occupational factors: union commitment (OR = 1.06; 95% CI: 1.00–1.12); exposure to dust (OR = 1.50; 95% CI: 1.15–1.95), exposure to chemicals (OR = 1.41; 95% CI: 1.11–1.79); and concern about exposure to occupational hazards (OR = 0.93; 95% CI: 0.91–0.95).

Conclusion—The findings highlight the need to explicate the pathways by which occupational factors may contribute to current smoking behavior among building trades workers. Smoking cessation programs for this population should consider work-related occupational factors along with individual approaches.

Keywords

cigarette smoking; blue-collar workers; occupational exposure; work environment; construction workers

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Disclosure Statement: The authors declare that there are no conflicts of interest.

INTRODUCTION

Cigarette smoking remains the single largest preventable cause of disease and premature death in the U.S. [U.S. DHHS, 2004]. Even though the rate of cigarette smoking has declined over the past 40 years in the U.S. [CDC, 2008], blue-collar workers have continued to have a high smoking prevalence [Covey et al., 1992; Nelson et al., 1994; Bang and Kim, 2001; Lee et al., 2007]. Over 30% of blue-collar workers still smoked cigarettes. In particular, construction workers had the highest prevalence of smoking at 38.8% [Lee et al., 2007]. Continual occupational disparity in smoking prevalence represents a critical public health concern because this gap may be associated with corresponding smoking-related health disparities [Fagan et al., 2004; Vidrine et al., 2009; Claessen et al., 2010; Dong et al., 2011].

Cigarette smoking among U.S. adults (age 18 and older) has been shown to be associated with individual factors, including sociodemographic characteristics such as age, gender, racial/ethnic group, educational attainment, and income level [Escobedo and Peddicord, 1996; Barbeau et al., 2004; CDC 2008, 2009]. Although work by Sorensen et al. [1996, 2009] have included occupational factors in smoking behaviors, the majority of studies on risk factors for smoking have focused on the individual risk factors for smoking without addressing the potential contribution of environmental risk factors.

Occupational factors might be one of the important factors in explaining persistent disparities in smoking prevalence by occupation. Workers exposed to occupational hazards have higher smoking rates than workers without such exposures [Sterling and Weinkam, 1990; Sorensen et al., 1996]. Blue-collar workers are more likely to be exposed to hazards on the job [Burkhart et al., 1993; Sorensen et al. 1996; Rappaport et al., 2003; Meeker et al., 2006], which can have adverse health effects, including cancer. Stressful and unsatisfactory working conditions might contribute to increased smoking [Westman et al., 1985; Alexander and Beck, 1990; Landsbergis et al., 1998; Radi et al., 2007; Peretti-Watel et al., 2009,]. This is because cigarette smoking may be a way of coping with these stressful work situations in order to get short-term relief from physically or mentally demanding work [Lundberg, 1999; Sorensen et al., 2004]. Thus, it is important to identify the factors in the work environment which contribute positively or negatively to smoking status.

The purpose of this study was to investigate the relationship between occupational factors and current cigarette smoking among building trades workers. Specifically, the paper examines exposure to occupational hazards (musculoskeletal disorders, dust, and chemical) and work characteristics (trade type, union commitment, and job satisfaction). Exploring the contribution of these occupational factors in relation to current cigarette smoking may provide important information about the work environment that can be used to reduce disparities in smoking and to improve work environments that promote smoking.

MATERIALS AND METHODS

Design

Data were from the MassBUILT study (2004 – 2007), which was designed to test an intervention to promote smoking cessation using randomized controlled trial (RCT) methodology. The data collection methodology and intervention has been described elsewhere [Okechukwu et al., 2009, 2010a, 2011]. In brief, the original study was conducted in collaboration with the Massachusetts building trades unions. Union halls, where the apprentice programs were located, were the sites for the study surveys and interventions. Each participating union conducts apprenticeship training programs for individuals wishing to become boilermakers, bricklayers, electricians, hoisting and portable engineers, ironworkers, painters, plumbers, pipefitters, sprinkler fitters, or refrigeration workers. All apprentices who were 18 years of age or older and were currently enrolled in the apprenticeship program were eligible to participate in the study [Okechukwu et al., 2009].

A self-reported baseline survey was conducted at ten union sites with 1,817 apprentices (93.6% response rate). The data described here were derived from these baseline surveys. The Dana-Farber Cancer Institute Institutional Review Board approved all methods and materials used in the original study. The University of California, San Francisco (UCSF) Committee on Human Subjects Research approved all study procedures for the present study.

Measures

Current cigarette smoking—Current cigarette smoking was defined using two criteria from the CDC guidelines: lifetime smoking of at least 100 cigarettes and smoking a cigarette in the last 30 days [National Center for Health Statistics, 2009].

Individual factors—*Sociodemographic characteristics* included age, gender, race/ethnicity, education, and household income. Race/ethnicity was categorized as Hispanic, non-Hispanic African American, non-Hispanic white, and “Other” (American Indian/Alaska Native, Asian, Native Hawaiian or other Pacific Islander). Educational attainment was originally organized into seven categories, which we subsequently collapsed to three: high school/GED or less, some college or 2 year degree, and 4 year college degree or more. Household annual income was categorized into seven $10,000 increments, which we also collapsed into three categories: <$50,000, $50,000-74,999, and $75,000 or more. *Self-rated health status* was assessed by a single question: “Would you say that, in general, your health is excellent, very good, good, fair, or poor”?

Occupational factors—All study participants were categorized into seven trades based on their trade type: electrician, plumber and pipefitter, bricklayer, ironworker, painter, sprinkler fitter, and operating engineer.

Union commitment was assessed by participants’ attitudes toward their unions on five statements, such as “I am proud to tell others that I am a union apprentice” [Lambert and Hopkins, 1995; Barbeau et al., 2005,]. Responses to each item were measured on a four-point Likert scale from 1 (*completely disagree*) to 4 (*completely agree*) (Cronbach's α =

0.73). The scale score were obtained by summing the five items with a higher score indicating a more positive view toward their union (range 5 – 20).

Job satisfaction was measured by a single question: “How satisfied are you with your job”? Responses were categorized as very, somewhat, not too, and not at all satisfied.

Exposure to occupational hazards included work-related musculoskeletal hazards, chemicals, dust, injury, and second-hand smoke (SHS) at work. *Work-related musculoskeletal hazards* modified from the Washington State Ergonomics Rule [2000] were assessed by asking the number of hours of exposure per full shift (almost never, <1, 1-4, and >4 hours) that included awkward postures of the shoulder, neck, back, or knee, repetitive hand motions, and hand force required to pinch or grip an object at work. For these questions, images of a human figure illustrating a particular posture were also shown on questionnaires. Exposures to chemicals and dust were assessed by asking about the frequency of exposure to these at work. SHS was assessed by asking about the frequency of exposure to SHS from others smoking at work. Injury was determined by assessing the number of events at work such as slips and falls, being struck by hoisted or falling objects, and cuts, strains, or sprains. Responses for *Dust*, *Chemicals*, *SHS*, and *Injury* were categorized as three levels and then dichotomized for the analyses as “a lot” or “rarely/never” due to small numbers of responses. Based on previous studies [Quinn et al., 2007; Okechukwu et al., 2010b], participants were classified as either exposed or unexposed to each occupational hazard, as the following criteria for use of the high exposure category: exposed more than four hours per work shift to awkward postures of the shoulder, neck, back, and knee, repetitive hand motions, or hand force; and exposed a lot to dust, chemicals, SHS, and injury. Each participant reporting these high exposures was classified as exposed to each hazard at work.

Concern about exposure to occupational hazards (e.g., dust, chemicals, SHS and work-related injuries) was assessed using six items on a four-point Likert scale from 1 (*not at all*) to 4 (*very concerned*) (Cronbach's $\alpha = 0.82$). The scale scores were obtained by summing the six items with a higher score indicating more concern about exposure to occupational hazards (range 6 –24).

Data Analysis

Statistical analysis was conducted using SPSS, version 19.0. Descriptive statistics were used to describe the participants in terms of individual and occupational factors using means, standard deviations, and range for continuous variables, and frequencies and percentages for categorical variables. Bivariate analysis was performed using chi-square tests and *t*-tests for categorical variables and continuous variables, respectively.

After bivariate analysis, multivariable logistic regression analysis was used to determine the significance of the associations between current cigarette smoking and individual and occupational factors. For the multivariable analysis, as an initial step, assessment for multicollinearity was conducted to check for high intercorrelations among independent variables. None were correlated at a level greater than $r = 0.4$, indicating there were no multicollinearity problems. Individual factors (sociodemographic characteristics, and self-

rated health status) were entered in the first block. In the second block, occupational factors (trade type, union commitment, job satisfaction, exposure to occupational hazards, and concern about exposure to occupational hazards) were added to the model. For ease of interpretation, reference groups for the logistic regression analyses were arbitrarily chosen, in some cases as those having the lowest risk for smoking; other reference groups were chosen because they reflected large sample sizes, increasing the stability of odds ratios.

Even though less than 5% of the data were missing for most variables, a substantial number of study participants (20.4%) were missing data on at least one key sociodemographic variable in the analyses. Income was the most frequently missing entry (n = 278, 15.3%). Regression analysis using listwise deletion could have led to loss of observations and biased estimates, and statistical power would have been reduced [Little and Rubin, 2002; Patrician, 2002]. Multiple imputation methods using SPSS Multiple Imputation [SPSS Inc., 2010] were used to handle missing data in multivariable analysis. Instead of imputing a single value for each missing value, the multiple imputation procedure developed by Rubin [1987] replaces each missing value with a set of plausible values. It can reflect the uncertainty about the missing data by creating several different plausible imputed datasets, and thereby preserving important data relationships and aspects of the data distribution [Rubin, 1996; Schafer, 1999]. The multiple imputation procedure involves generating multiple imputed data sets, analyzing them separately by using standard procedures for complete data, and then appropriately combining the results obtained from each of them [Schafer, 1999; Little and Rubin, 2002; Patrician 2002; White et al., 2011]. Five imputed datasets, which were considered to be appropriate, were created [Rubin, 1996; Schafer, 1999; Allison. 2002]. All variables included in the analysis model were part of the imputation model used to predict the missing data. Multivariable logistic regression analysis was performed on each of the imputed data sets separately, and then finally statistically pooled (i.e., combined) to achieve single parameter estimates. For each variable, pooled estimates from the five imputed datasets were used to report the odds ratios (ORs) and 95% confidence intervals (95% CI), along with a corresponding *P*-value. The level of statistical significance was set at a *P*-value of < 0.05.

RESULTS

Characteristics of the Participants

The individual and occupational characteristics of the study participants are shown in Table I, prior to imputing missing covariates. Approximately 43% of the participants (n = 763) were classified as current smokers. Over 60% (n = 468) of current smokers reported smoking more than 10 cigarettes per day during the past 30 days. The vast majority of the study participants were male (92.4%) and non-Hispanic white (76.4%) with an average age of 28.5 years. Only 8.5% of the study participants had completed 4 years of college or more. The majority of them were electricians (41.5%), followed by plumbers and pipefitters (31.7%). More than half (59.5%) reported being very satisfied with their jobs. The most commonly reported exposure was dust (76.7%), followed by work-related musculoskeletal hazards (57%), SHS (42.7%), injuries (29%), and chemicals (27.5%).

Participant Characteristics by Smoking Status

Table I also lists the differences in individual and occupational factors by current smoking status. Current smokers were significantly younger (27.7 years vs. 29.1 years, $P < 0.001$), more likely to be non-Hispanic white (81.1% vs. 73.5%, $P = 0.002$) to report a high school education or less (51.4% vs. 47.8%, $P = 0.026$), and were less likely to report their health as being excellent (10.1% vs. 17.4%, $P < 0.001$), compared to nonsmokers. Also, current smokers were significantly more likely than nonsmokers to report exposure to dust (80.1% vs. 74.2%, $P = 0.015$), and chemicals (31.2% vs. 24.8%, $p = 0.011$), and were significantly less likely to be concerned about exposures to occupational hazards (14.9 vs. 16.2, $P < 0.001$).

Multivariable Logistic Regression Analyses

Table II presents the factors associated with current smoking in the multivariable logistic regression models. Model 1, which included the individual factors as predictors of current cigarette smoking, shows that older age was significantly associated with lower likelihood of current smoking (OR = 0.97; 95% CI: 0.95–0.98). Female workers were more likely to be current smokers than male workers (OR = 1.67; 95% CI: 1.06–2.62). Hispanics (OR = 0.44; 95% CI: 0.25–0.78) and non-Hispanic African Americans (OR = 0.57; 95% CI: 0.38–0.86) were significantly less likely to report current smoking than non-Hispanic whites. However, the interpretation of these results is limited due to relatively small numbers of females and those in the non-white racial and ethnic groups. Compared to workers whose income was more than $75,000, those with a household annual income of $50,000–74,999 were significantly more likely to be current smokers (OR = 1.40; 95% CI: 1.06–1.86), as were those who reported less than $50,000 income (OR = 1.30; 95% CI: 1.01–1.66). Those with lower educational attainment, some college or a 2-year college degree (OR = 1.67; 95% CI: 1.13–2.46) or high school or less (OR = 1.59; 95% CI: 1.08–2.32) were significantly more likely to be current smokers than those with 4 years of college or more. Compared to those who reported excellent health status, those who reported poor health status were significantly more likely to be current smokers (OR = 4.91; 95% CI: 1.32–18.23), followed by fair (OR = 3.61; 95% CI: 2.21–5.90), good (OR = 2.41; 95% CI: 1.76–3.31), and very good (OR = 1.37; 95% CI: 1.00–1.88).

With the addition of occupational factors in Model 2, age, race/ethnicity, household annual income, education, and self-rated health status continued to demonstrate similar effects to those observed in Model 1. However, gender was no longer significantly associated with the likelihood of current smoking ($p = 0.178$). Regarding occupational factors, having a positive view of the union was significantly associated with a higher likelihood of current smoking (OR = 1.06; 95% CI: 1.00–1.12). Also, higher exposure to dust (OR = 1.50; 95% CI: 1.15–1.95) and chemicals (OR = 1.41; 95% CI: 1.11–1.79) were significantly associated with increased likelihood of current smoking while more concern about exposure to these occupational hazards was significantly associated with a lower likelihood of current smoking (OR = 0.93; 95% CI: 0.91–0.95). However, the type of trade, job satisfaction, exposures to work-related musculoskeletal hazards, SHS, and injuries were not significantly associated with any differences in the odds of current smoking after adjusting for the other variables in the model.

DISCUSSION

The study investigated the contribution of occupational factors to current cigarette smoking among building trades workers. The building trades workers in this study reported a smoking prevalence of more than 40%, nearly twice as high as that of the U.S. general population and white-collar workers during the same period [Barbeau et al., 2004; Lee et al., 2007; CDC, 2009]. The high prevalence of cigarette smoking among blue-collar workers is consistent with findings from prior U.S. national studies of smoking and occupation [Giovino et al., 2000; Barbeau et al., 2004; Lee et al., 2007]. For example, in an analysis of data from the 1997 to 2004 National Health Interview Survey (NHIS; N = 298,042), all of the 13 occupations with smoking rates above 30% were blue-collar [Lee et al., 2007].

Consistent with prior research findings [Escobedo and Peddicord, 1996; Cavelaars et al. 2000; Kaleta et al. 2006; CDC, 2008, 2009; Barbeau et al. 2004; Nakata et al., 2009,], age, race/ethnicity, income and educational level, and health status were significantly associated with current smoking. Union commitment was significantly associated with current smoking, even after adjustment for the individual factors. Although the extent of the odds of current smoking with union commitment was small, the finding indicated that most study participants felt a strong union commitment, and those who had more positive views about their union had a higher likelihood of current smoking. Barbeau et al. [2005] found that an important theme connected to union membership for unionized construction workers was a sense of belonging. They concluded that, as with smoking, workers may feel a sense of belonging–instant membership–with a group of smoking coworkers, which is something they potentially lose if they quit smoking [Barbeau et al., 2005]. Smoking cessation efforts targeting this group of workers have to consider this important role of unions. Such efforts should also consider ways that unions can advocate for work environments that promote smoking cessation, such as worksite smoking policies (e.g., smoking restrictions, smoking bans) [Sorensen et al. 2000] or health insurance coverage of smoking cessation [Curry et al., 1998; Barbeau, 2001; Barbeau et al., 2001].

Another important finding of the present study was that exposures to dust and chemicals at work were significantly associated with an increased likelihood of current smoking while more concern about exposure to occupational hazards was significantly associated with a lower likelihood of current smoking. Previous research with craftspersons and laborers showed that workers reporting exposure to chemical hazards on the job were significantly more likely to be smokers than were unexposed workers [Sorensen et al., 1996]. Also, compared with unexposed workers, smokers exposed to chemical hazards were significantly more likely to be thinking of quitting or taking action to quit [Sorensen et al., 1996]. Concern about chemical hazards was further associated with an increased interest in quitting among men [Sorensen et al., 1996]. In contrast, Okechukwu et al. [2010b] found no significant difference in the association between exposure to occupational hazards (i.e., dust, chemicals, noise and ergonomics strain) and smoking among blue-collar workers; however, workers exposed to chemicals and dust tended to be at increased risk of smoking. As the authors pointed out in that paper, the high and limited range of exposure to occupational hazards in their population might have limited their ability to find any associations. Blue-collar workers tend to have higher exposures to occupational hazards, specifically

carcinogens such as silica [Burkhart et al., 1993; Sorensen et al., 1996; Rappaport et al., 2003; Meeker et al., 2006], which might exacerbate smoking-related health problems.

Hazardous exposures on the job (e.g., dust, chemicals) are typical job stressors for construction workers [Goldenhar et al., 1998]. Smokers often report that they feel pressure to continue to smoke in stressful job situations [Thompson et al., 2003] and that smoking helps to temporarily relieve feelings of stress [Lundberg, 1999; Sorensen et al., 2004]. Indeed, workers with risks of exposure to these hazards on the job have higher behavioral risk of smoking. These multiple risks, exposure to occupational hazards and higher smoking prevalence, may have a complex effect on workers' health [U.S. DHHS, 1989; Barbeau et al., 2001; Sorensen et al., 2004]. The findings from the current study support the use of integrated interventions that address both hazards [Sorensen et al., 2002]. Such interventions may help to reduce smoking rates among blue-collar workers and improve worker health by creating healthier workplaces.

In the U.S. Surgeon General's Report, SHS is a major cause of substantial health dangers in healthy nonsmokers [U.S. DHHS, 2006]. Even though the present study found that exposure to SHS was not significantly associated with current smoking, 42% of nonsmokers in the present study were exposed to SHS at work. The National Health and Nutrition Examination Survey (NHANES) studies have consistently found that blue-collar workers have higher exposure to SHS than workers in other occupations [Wortley et al., 2002; Arheart et al., 2008]. Smoking policies that restrict or ban smoking in the workplace can decrease workers' exposure to SHS [Hammond et al., 1995; Arheart et al., 2008] and can reduce cigarette smoking during working hours [Fichtenberg and Glantz, 2002]. Smoke-free workplace policies vary by occupation [Gerlach et al., 1997; Shopland et al., 2004; Plescia et al. 2005; U.S. DHHS 2006]. Blue-collar workers are less likely to report smoke-free workplaces than white-collar workers [Shopland et al., 2004]. Furthermore, blue-collar workplaces have been slow to implement smoking bans [U.S. DHHS, 2006]. Therefore, implementation of smoke-free policies at blue-collar workplaces may protect nonsmokers from SHS exposure at work.

Strengths and Limitations

This study has a number of strengths. First, the study had a high response rate and was able to obtain data confidentially from a large number of apprentices from diverse building trades. Thus, it had a high statistical power to detect moderate to small effects. This also suggests that selection bias in which those who were differentially exposed to smoking were more likely to answer the study questionnaire is not a likely problem. Also, multiple imputation methods allowed us to preserve information from participants with missing data in estimating the regression model. Therefore, these methods minimized validity bias and had more statistical power than the often used listwise method of deleting all observations with missing values on any covariate [Rubin, 1987; Allison, 2002; Little and Rubin, 2002; Patrician, 2002].

Despite these strengths, several study limitations should be noted. First, due to the cross-sectional nature of the design of the current study, it is not possible to determine temporality or causal direction between exposures and current smoking. Second, the use of self-report of exposures and outcomes in the study might have led to differential or non-differential

misclassification. Self-report of exposure to occupational hazards may under- or overestimate actual hazardous exposures [Birdsong et al., 1992; Brower and Attfield, 1998; Spielholz et al., 2001; Van Eerd et al., 2009,]. The study also uses self-report of smoking status without the benefit of biochemical verification. However, smoking status was assessed by standard measures drawn from a national survey [National Center for Health Statistics, 2009], which requires smokers to meet two criteria. Also, self-reports are generally reliable for classifying smoking status [Patrick et al., 1994; Caraballo et al., 2001]. Third, the study participants were all unionized workers working at union construction worksites, which limits the generalizability of the findings. Furthermore, the study participants included apprentices, who are in the younger age range for blue-collar workers. The findings from this study might not be representative of the general blue-collar worker population, which includes workers with longer work years in the trades. Finally, all variables that would have been useful to analyze from an occupational perspective were not available, raising the possibility of residual confounding by unmeasured or unadjusted factors. It would have been useful to have information about job strain [Green and Johnson, 1990; Hellerstedt and Jeffery, 1997; Landsbergis et al., 1998; Kouvonen et al., 2007], shift work [Shields, 1999], and worksite smoking policies [Fichtenberg and Glantz, 2002], all of which may contribute to the increased likelihood of smoking.

CONCLUSION

Despite these limitations, the study findings highlight the need to explicate the pathways by which occupational factors may contribute to current smoking behavior among building trades workers. Specifically, there was strong evidence that higher exposure to chemicals and dust was associated with increased current smoking among building trades workers, although any directionality in the association could not be inferred. This study provides strong support for future studies to consider work-related occupational factors along with individual approaches in understanding smoking and when developing smoking cessation programs for this population.

ACKNOWLEDGEMENTS

The original study was funded by the National Center for Chronic Disease Prevention and Health Promotion; Grant number: 1R01 DP000097-01 (PI. Dr. Elizabeth M. Barbeau). The present study was supported by grants from the American Nurse Foundation, the Alpha Eta Chapter of Sigma Theta Tau International, the UCSF Graduate Division, and the UCSF School of Nursing Century Club.

Contract grant sponsor: National Center for Chronic Disease Prevention and Health Promotion ; Contract grant number: 1R01DP000097-01 (original study); Contract grant sponsor: American Nurse Foundation; Contract grant sponsor: Alpha Eta Chapter of Sigma Theta Tau International; Contract grant sponsor: Graduate Division, University of California, San Francisco; Contract grant sponsor: School of Nursing Century Club, University of California, San Francisco.

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Table I

Individual and Occupational Factors by Current Smoking among Building Trades Workers (N=1,817)

Characteristics	Total N=1,817	Total[a]		*P*-value[*]
		Current Smoker N=763, 42.7%	Non Smoker N=1025, 57.3%	
Individual factors				
Age (year)				<0.001
Mean ± SD (range)	28.5 ± 6.6 (18–53)	27.7 ± 5.9 (18–49)	29.1 ± 7.0 (18–53)	
Gender, n (%)				0.351
Male	1679 (92.4)	700 (91.7)	957 (93.4)	
Female	88 (4.8)	44 (5.8)	44 (4.3)	
Missing	50 (2.8)	19 (2.5)	24 (2.3)	
Race/Ethnicity, n (%)				0.002
Hispanic	65 (3.6)	18 (2.4)	44(4.3)	
African America, non-Hispanic	125 (6.9)	40 (5.2)	85(8.3)	
Other, non-Hispanic	114 (6.3)	44 (5.8)	69(6.7)	
White, non-Hispanic	1389 (76.4)	619 (81.1)	753 (73.5)	
Missing	124 (6.8)	42 (5.5)	74 (7.2)	
Education, n (%)				0.026
High school/GED[b] or less	894 (49.2)	392 (51.4)	490 (47.8)	
Some college or 2-year degree	674 (37.1)	287 (37.6)	379 (37.0)	
4-year college degree or more	155 (8.5)	48 (6.3)	105 (10.2)	
Missing	94 (5.2)	36 (4.7)	51 (5.0)	
Income, n (%)				0.090
<$50,000	675 (37.1)	301 (39.4)	365 (35.6)	
$50,000-74,999	390 (21.5)	172 (22.5)	211 (20.6)	
≥$75,000	474 (26.1)	181 (23.7)	291 (28.4)	
Missing	278 (15.3)	109 (14.3)	158 (15.4)	
Self-rated health, n (%)				<0.001
Excellent	260 (14.3)	77 (10.1)	178 (17.4)	
Very good	768 (42.3)	282 (37.0)	475 (46.3)	
Good	655 (36.0)	332 (43.5)	316 (30.8)	
Fair	108 (5.9)	63 (8.3)	41 (4.0)	
Poor	11 (0.6)	7 (0.9)	4 (0.4)	
Missing	15 (0.8)	2 (0.3)	11 (1.1)	
Occupational factors				
Trade type, n (%)				0.807
Electricians	754 (41.5)	303 (39.7)	439 (42.8)	
Plumbers and pipefitters	576 (31.7)	245 (32.1)	327 (31.9)	
Bricklayers	152 (8.4)	68 (8.9)	76 (7.4)	
Ironworkers	110 (6.1)	50 (6.6)	59 (5.8)	
Painters	117 (6.4)	50 (6.6)	63 (6.1)	

Characteristics	Total N=1,817	Total[a] Current Smoker N=763, 42.7%	Total[a] Non Smoker N=1025, 57.3%	*P*-value*
Sprinkler fitters	78 (4.3)	33 (4.3)	45 (4.4)	
Operating engineers	30 (1.7)	14 (1.8)	16 (1.6)	
Union commitment[c]				0.215
Mean ± SD (range)	17.7±2.0 (9–20)	17.8 ± 2.0 (9–20)	17.6 ± 2.0 (9–20)	
Job satisfaction, n (%)				0.144
Very satisfied	1081 (59.5)	468 (61.3)	599 (58.4)	
Somewhat satisfied	525 (32.0)	232 (30.4)	341 (33.3)	
Not too satisfied	101 (5.6)	40 (5.2)	59 (5.8)	
Not at all satisfied	24 (1.3)	14 (1.8)	8 (0.8)	
Missing	29 (1.6)	9 (1.2)	18 (1.8)	
Exposure to occupational hazards				
Work-related musculoskeletal hazards, n (%)				0.064
Exposed	1036 (57.0)	456 (59.8)	565 (55.1)	
Not exposed	770 (42.4)	305 (40.0)	452 (44.1)	
Missing	11 (0.6)	2 (0.3)	8 (0.8)	
Dust, n (%)				0.015
Exposed	1394 (76.7)	611 (80.1)	761 (74.2)	
Unexposed	397 (21.8)	143 (18.7)	249 (24.3)	
Missing	26 (1.4)	9 (1.2)	15 (1.5)	
Chemicals, n (%)				0.011
Exposed	499 (27.5)	238 (31.2)	254 (24.8)	
Unexposed	1290 (71.0)	516 (67.6)	756 (73.8)	
Missing	28 (1.5)	9 (1.2)	15 (1.5)	
SHS[d], n (%)				0.073
Exposed	776 (42.7)	339 (44.4)	429 (41.9)	
Unexposed	1021 (56.2)	421 (55.2)	582 (56.8)	
Missing	20 (1.1)	3(0.4)	14 (1.4)	
Injuries, n (%)				0.760
Exposed	527 (29.0)	227 (29.8)	295 (28.8)	
Unexposed	1272 (70.0)	530 (69.5)	719 (70.1)	
Missing	18 (1.0)	6 (0.8)	11 (1.1)	
Concern about exposure to occupational hazards[e]				<0.001
Mean ± SD (range)	15.6 ± 4.5 (6–24)	14.9 ± 4.3 (6–24)	16.2 ± 4.6 (6–24)	

All values were calculated prior to imputing missing covariates.

[a] Twenty-nine participants did not reply to the smoking outcome variable.

[b] GED, general educational development.

[c] A high score indicates more a positive view toward the union.

[d] SHS, second-hand smoke.

[e] A high score indicates more concern about exposure to occupational hazards.

[*] *P* value for χ^2 test or *t*-test.

Table II

Multivariable Association of Individual and Occupational Factors with Current Smoking (N = 1,817)

Variables	Model 1		Model 2	
	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Individual factors				
Age (continuous)	0.97 (0.95–0.98)	<0.001	0.97 (0.96–0.99)	0.002
Gender				
Female	1.67 (1.06–2.62)	0.026	1.37 (0.87–2.17)	0.178
Male	Reference			
Race				
Hispanic	0.44 (0.25–0.78)	0.005	0.46 (0.26–0.83)	0.010
African American	0.57 (0.38–0.86)	0.007	0.61 (0.40–0.93)	0.021
Other	0.79 (0.52–1.20)	0.271	0.89 (0.58–1.36)	0.580
White, non-Hispanic	Reference			
Income				
<$50,000	1.30 (1.01–1.66)	0.041	1.31 (1.01–1.70)	0.040
$50,000-74,999	1.40 (1.06–1.86)	0.019	1.44 (1.08–1.92)	0.013
≥$75,000	Reference			
Education				
High school/GED[a] or less	1.59 (1.08–2.32)	0.018	1.49 (1.01–2.20)	0.044
Some college or 2-year degree	1.67 (1.13–2.46)	0.010	1.61 (1.08–2.39)	0.019
4-year college degree or more	Reference			
Self-rated health				
Poor	4.91 (1.32–18.23)	0.018	6.33 (1.66–24.17)	<0.007
Fair	3.61 (2.21–5.90)	<0.001	3.79 (2.27–6.34)	<0.001
Good	2.41 (1.76–3.31)	<0.001	2.63 (1.89–3.66)	<0.001
Very good	1.37 (1.00–1.88)	0.047	1.48 (1.08–2.05)	0.016
Excellent	Reference			
Occupational factors				
Trade type				
Plumbers and Pipefitters			0.93 (0.73–1.18)	0.552
Bricklayers			1.13 (0.77–1.67)	0.533
Ironworkers			1.40 (0.91–2.15)	0.130
Painters			1.11 (0.72–1.72)	0.636
Sprinkler fitters			1.10 (0.66–1.81)	0.724
Operating engineers			1.23 (0.57–2.63)	0.603
Electricians			Reference	
Union commitment (continuous)			1.06 (1.00–1.12)	0.043
Job satisfaction				
Not at all satisfied			1.75 (0.64–4.76)	0.269
Not too satisfied			0.76 (0.48–1.20)	0.234

Variables	Model 1		Model 2	
	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Somewhat satisfied			0.85 (0.67–1.07)	0.157
Very satisfied			Reference	
Exposure to occupational hazards[b]				
Work-related musculoskeletal hazards			1.11 (0.90–1.37)	0.313
Dust			1.50 (1.15–1.95)	0.002
Chemicals			1.41 (1.11–1.79)	0.005
SHS[c]			1.12 (0.91–1.39)	0.290
Injuries			1.03 (0.82–1.30)	0.798
Concern about exposure to occupational hazards (continuous)			0.93 (0.91–0.95)	<0.001

[a] GED, general educational development.

[b] Unexposed to each occupational hazard is the reference group.

[c] SHS, second-hand smoke; OR, odds ratio, CI, confidence interval.