

Smoking Patterns, Quit Behaviors, and Smoking Environment of Workers in Small Manufacturing Companies

Erika A. Pinsker, MPH,^{1*} Deborah J. Hennrikus, PhD,¹ Peter J. Hannan, MStat,¹ Harry A. Lando, PhD,¹ and Lisa M. Brosseau, ScD²

Background *This study describes smokers employed at 47 small manufacturing companies in Minnesota, USA.*

Methods *Smokers (n = 713) participating in a group-randomized trial completed a baseline survey on their smoking patterns, quit behaviors, smoking environment, workplace attitudes about smoking, and correlates of smoking. These characteristics were examined by job type and a latent class analysis (LCA) was performed to group workers with similar characteristics.*

Results *Production workers had the highest prevalence of daily smoking (88% vs. 68% among managers), and addiction (61% vs. 26% among managers), and the highest mean level of perceived stress (6.4 vs. 4.9 among managers). The LCA identified three subgroups of smokers that differed in levels of barriers to cessation. Production workers were most likely to be in the group with greater barriers (P = 0.01).*

Conclusions *These results underscore the importance of targeting interventions to production workers and those who exhibit the greatest barriers to cessation.* Am. J. Ind. Med. 58:996–1007, 2015. © 2015 Wiley Periodicals, Inc.

KEY WORDS: *workplace; occupations; smoking; smoking cessation; manufacturing workers; blue-collar workers; occupational health*

INTRODUCTION

Although smoking rates have declined among those with white-collar occupations, prevalence of smoking among blue-collar workers (e.g., production, maintenance, construction, and other laborers) has remained high [Barbeau et al., 2004; Lee et al., 2007]. The smoking prevalence among all manufacturing workers is high at approximately 24%

[National Center for Health Statistics, 2013]. However, there are differences among job types with rates ranging from 16% among managers to 29% among production workers [National Center for Health Statistics, 2013]. Approximately 70% of manufacturing workers are blue-collar production workers and workers in other nonsupervisory positions [United States Department of Labor, 2014]. Manufacturing workers are at risk for exposure to occupational risk factors that pose independent health risks, and in combination to smoking can lead to elevated risk of disease [Walsh et al., 1991; Sorensen et al., 1996; Schulte et al., 2012; Pronk NP, 2013]. Therefore, research on smoking and cessation is especially important among this population.

While there has been research on smoking prevalence among manufacturing workers, there has been little research on smoking patterns, quit behaviors, smoking environment, workplace attitudes about smoking, and correlates of smoking among this group [Centers for

¹Division of Epidemiology and Community Health, University of Minnesota School of Public Health, Minneapolis, Minnesota

²Department of Environmental and Occupational Health Sciences, University of Illinois at Chicago School of Public Health, Chicago, Illinois

*Correspondence to: Erika A. Pinsker, MPH, Division of Epidemiology and Community Health, University of Minnesota School of Public Health, 1300 S 2nd St. #300, Minneapolis, MN 55454. E-mail: pinsk018@umn.edu

Disease Control and Prevention, 2010]. Among general population groups, previous research has found that smoking patterns such as amount (number of cigarettes per day) and frequency (daily vs. nondaily smoking) smoked, and greater dependence on smoking predict failure to quit [Richmond et al., 1993; Farkas et al., 1996; Hyland et al., 2006; Tindle and Shiffman, 2011; Walker and Loprinzi, 2014]. Several quit behaviors have been found to be associated with successful smoking cessation, such as talking to a doctor about quitting, [Senore et al., 1998; Lancaster et al., 2000; Fiore et al., 2008] having attempted to quit in the past, [Borland et al., 1991; Hyland et al., 2006] expressing intentions to quit and confidence in one's ability to quit, [Borland et al., 1991; Mackenzie et al., 2004; Hyland et al., 2006], and the use of cessation aids either alone or in combination, such as nicotine replacement therapy, cessation medications, and smoking cessation programs [Hartmann-Boyce et al., 2013]. In addition, environmental factors are related to smoking cessation. For instance, individuals who live with another smoker or have a large proportion of friends and coworkers who smoke are less likely to be successful at quitting, [Richmond et al., 1993; Senore et al., 1998; Monsó et al., 2001; Walker and Loprinzi, 2014] whereas individuals who receive support for smoking cessation from those around them are more likely to succeed [Borland et al., 1991; Lawhon et al., 2009].

In terms of correlates of smoking, high levels of stress, including general life stress and job stress, have been found to be associated with high prevalence of smoking, [Green and Johnson, 1990; Brisson et al., 2000; Kassel et al., 2003] and individuals with high stress levels have more difficulty quitting smoking [Ayyagari and Sindelar, 2010; Bryant et al., 2011]. In addition, many individuals who drink alcohol also smoke cigarettes, [Hughes, 1995; Falk et al., 2006] and current alcohol use is associated with lower likelihood of smoking cessation [Breslau et al., 1996; Hays et al., 1999; Satre et al., 2007; Reitzel et al., 2014]. Previous research has also found that advice from a doctor increases the quit rate among patients [Kottke et al., 1988; Fiore et al., 2008; Lancaster et al., 2000]. Therefore, individuals who visit the doctor and dentist regularly may be more likely to receive such advice and, as a result, more likely to quit smoking. Lastly, individuals who smoke have been found to be less physically active than former or never smokers [Kaczynski et al., 2008; Wen et al., 2011]. Those who smoke and are physically active, are more likely to attempt to quit smoking [deRuiter et al., 2008].

This paper focuses on a wide range of behaviors and characteristics of smokers employed at small manufacturing companies, defined as companies employing between 20 and 150 individuals. Although small manufacturing companies represent one fifth of all manufacturing companies in the U.S., [United States Census Bureau, 2010] and constitute

an important site for blue-collar worker employment, [United States Department of Labor, 2014] most of the research on workplace health among manufacturing workers has focused on larger companies employing greater than 150 workers [Emmons et al., 1994; Sorensen et al., 2003; Yap et al., 2009; Brehm et al., 2011]. As smaller worksites are less likely to offer worksite wellness programs due to barriers including lack of resources, personnel to oversee such programs, and expertise on health promotion, workers at small manufacturing workplaces represent a priority population for health research and promotion [Linnan et al., 2008; Harris et al., 2014].

In addition, much of the research that has focused on job types and smoking has classified production workers and managers as two distinct job types [Lee et al., 2007; Smith and Leggat, 2007; Ayyagari and Sindelar, 2010]. However, we found that some employees consider themselves to be both production workers and managers (i.e., production managers). Therefore, this paper examines the behaviors and characteristics of production managers, or production staff who also have a managerial or supervisory role, and compares them to those of employees in other job types. The aims of this paper are to 1) describe the smoking patterns, quit behaviors, smoking environment, workplace attitudes about smoking, and correlates of smoking in workers employed at small manufacturing companies; 2) explore differences in these behaviors and characteristics by job type (managers, production managers, production staff, support, research and development or engineering, and sales); and 3) identify subgroups of workers with similar smoking behaviors and characteristics.

MATERIALS AND METHODS

Research Design

This report is an analysis of the baseline data from the Wellness Works study. Wellness Works was a group randomized trial in which small manufacturing workplaces were randomized to either an immediate or delayed intervention targeting workplace safety and smoking cessation. Randomization to each treatment condition occurred after the completion of a baseline survey of all employees.

Subjects and Data Collection Procedures

Workplace recruitment

Forty-seven small manufacturing businesses located in the Minneapolis and St. Paul metro area of Minnesota participated in the study. Eligibility criteria included employing 20–150 workers, being a manufacturing

company, being an independent company or a subsidiary that has latitude to make independent decisions about health and safety improvements, anticipate no major changes in the company in the upcoming year, employ at least four smokers, and agree to study procedures. Companies had to be able to make independent decisions about health and safety improvements and have at least four smokers to ensure that they would be able to participate in the safety-smoking cessation intervention and benefit from participation.

Manufacturing businesses were identified from two databases that enumerate all businesses in the U.S., Reference USA and D&B Million Dollar. Being a manufacturer was determined using the manufacturing field on these databases and verified using the North American Industry Classification System (codes: 31, 32, 33). We identified 2,716 businesses using the databases, however initial screening excluded 1,562 businesses due to ineligibility and the presence of duplicates. We attempted to contact 1,154 companies that met size and type of business criteria to complete the screening process and invite participation; 852 of these businesses did not meet eligibility criteria or were not reachable. Three hundred and two businesses were found to be eligible, 84 of these businesses were sufficiently interested to agree to a recruitment visit, and 47 businesses enrolled in the study. Examination of the characteristics of participating companies and the socio-demographic characteristics of their employees indicated that the companies are roughly representative of small manufacturing companies in the Twin Cities region (Egelhoff et al., In Press).

Survey procedure and participants

Baseline data were collected through surveys of employees at participating businesses between December 2010 and November 2012. In most cases, study staff administered the survey during work time. Survey packets included a letter explaining the survey, the survey, and a \$2 bill as an incentive. At businesses that did not allow release time from work to complete the survey, we conducted a drawing for a \$25 gift card for survey completers. If surveys were not received within 10 business days, we re-sent surveys to non-completers. Surveys translated into Spanish and Hmong were provided at workplaces that had workers who preferred to complete the survey in their native language.

Eighty-six percent (2652/3072) of the employees working at the 47 participating businesses completed the baseline survey. Return rates for individual businesses ranged between 50% and 100%; the median return rate was 90%. Prevalence of smoking among all manufacturing workers sampled was 27% ($n = 713$). By job type, smoking prevalence was highest among production workers (32%), followed by production managers (26%), support staff (25%), sales staff (21%), research and development/

engineering (16%), and managers (11%). The 713 smokers comprise the sample for this paper.

The companies that did not allow on-site survey administration ($n = 6$) tended to have lower return rates (between 50% and 84%). The smoking prevalence in these lower-response companies ranged between 8% and 35%; it was not consistently higher or lower than the overall prevalence found in all companies (i.e., 27%).

This study was approved by the University of Minnesota Research Subjects Protection Programs Institutional Review Board Human Subjects Committee. Written informed consent was obtained from all participants.

Measures

Demographic characteristics and job type

Demographic characteristics included: age, sex, ethnicity (Hispanic/Latino or not), race (White, Black or African American, Asian, Native Hawaiian or Other Pacific Islander, American Indian/Alaska Native, Other), and education level (Grade School, Junior High, High School, Vocational Training beyond High School, Some college, College/University Degree, Graduate or Professional Education). Multiple imputation was used to impute small amounts of missing data for race (4% of sample), age (2%), and education level (2%). For analyses, race/ethnicity was dichotomized into White or Other and education level was dichotomized into High School or Less and More than High School.

To assess job type, respondents were asked to select all job types that applied to them from a list of ten: support, production, sales, management, research and development, engineering, quality control, inventory/shipping, maintenance, and other (specify). We then grouped the responses into six job type categories based on similarity of job type: 1) production workers (those who selected only production and/or production-like jobs such as quality control, inventory-shipping, and maintenance), 2) management (those who selected only management), 3) production managers (those who selected both production or production-like jobs and management), 4) sales, 5) support, and 6) research and development or engineering.

Smoking patterns

Respondents were asked whether they had smoked a cigarette, even a puff, in the last seven days [Hughes et al., 2003]. They were then asked if they had ever smoked cigarettes on a regular basis (i.e., at least 100 cigarettes in their lifetime) [Centers for Disease Control and Prevention, 2012]. Those who had smoked regularly were asked whether they now smoked cigarettes every day, some days, or not at

all. A respondent was considered a smoker if s/he indicated smoking at least 100 cigarettes in his/her life and being a current daily or nondaily smoker.

Other smoking patterns measured were number of cigarettes smoked per day (daily smokers only) or per month (nondaily smokers only; this was converted to cigarettes per day for analyses); addiction to smoking (i.e. whether the first cigarette of the day was smoked within 30 minutes of waking); [Heatherton et al., 1991] and use of smokeless tobacco. The respondent was asked if he/she currently used smokeless tobacco, including chewing tobacco, snuff, or snus every day, some days, or not at all [Centers for Disease Control and Prevention, 2009]. Those who responded that they used smokeless tobacco daily or some days were considered smokeless users.

Quit behaviors

Participants were asked whether they had quit smoking for 24 hours or more in the preceding year, talked with a doctor about quitting smoking in the past 12 months, were seriously considering quitting smoking in the next 6 months, [National Cancer Institute, 2003] and their level of confidence that they would be able to quit smoking permanently (e.g., self-efficacy to quit) on a scale of 0 (not at all confident) to 10 (very confident). The survey also included questions about ever use of a formal quit-smoking program, nicotine replacement therapy (nicotine patch, gum, lozenge, inhaler, and/or nasal spray), and cessation medication (Zyban or bupropion, Chantix or Varenicline).

Smoking environment

Respondents were asked whether there are other smokers in their household and the proportion of their close friends and coworkers who currently smoke cigarettes (almost all, more than half, about half, less than half, almost none, and none). For most analyses, the proportion of close friends and coworkers who currently smoke was collapsed into half or more and less than half. The respondent was also asked to rate on a scale of 1 (not at all supportive) to 5 (extremely supportive) how supportive each of the following groups would be of the respondent quitting smoking: family, friends, coworkers, and company management.

Workplace attitudes about smoking

Respondents were asked how many coworkers: “Would support people at this workplace who are trying to quit smoking” and “Think that smoking is a bad habit” (few or none, some, most or all) [Ribisl and Reischl, 1993]. For analyses, these items were collapsed into most/all and some/less.

Correlates of smoking

Perceived stress was assessed by the 4-item Perceived Stress Scale, a widely used instrument whose reliability and validity has been demonstrated in many populations [Cohen and Williamson, 1988]. Respondents rated the frequency in the past month of experiencing four feelings (e.g., feeling unable to control the important things in one’s life; feeling that things were going one’s way) on a scale of 0 (never) to 4 (very often). The Cronbach’s alpha for these items in baseline survey respondents was 0.71, indicating acceptable reliability. A perceived stress total score was calculated, with high scores associated with high perceived stress.

Job stress was assessed by five items adapted by Sapp et al., 2010 from the Karasek Job Content Questionnaire [Karasek et al., 1998]. Two items measured job demands (e.g., “My job makes conflicting demands on me”); one item assessed skill discretion (“I have a lot of say about what happens on my job”); and two items assessed decision authority (e.g., “My job requires that I learn new things”). As suggested by Sapp et al. we created a weighted measure of job control from the skill discretion and decision authority items and then subtracted the job control measure from the sum of the job demand items. After shifting to make the minimum zero, and scaling to make the maximum 8, the resulting measure of job stress varied from 0 to 8 and was roughly normally distributed.

Respondents were asked if they had had at least one drink of any alcoholic beverage in the last 30 days [Centers for Disease Control and Prevention, 2009]. Those who had were asked how many days per week or per month they had consumed at least one drink of any alcoholic beverage in the last 30 days and, during that period, about how many drinks they consumed on the days that they drank. We calculated the total number of alcoholic drinks per month and then divided by 30 to generate drinks per day. Women who averaged more than one drink per day and men who averaged more than two were considered risky alcohol users [National Institute on Alcohol Abuse and Alcoholism, 2014].

We asked respondents how long it had been since they visited a doctor and a dentist for a routine checkup [Centers for Disease Control and Prevention, 2009]. For each provider, they indicated whether the visit was within the past year, 2 years, 5 years, or 5 or more years ago. For most analyses, time since last check-up was dichotomized into within the past year and more than 1 year.

Participants were asked the number of days in a usual week that they did moderate and vigorous physical activity outside of work for more than 10 minutes; and for days on which they were moderately and vigorously active for at least ten minutes, how much total time per day the respondent did those activities [Centers for Disease Control and Prevention, 2009]. Total physical activity was calculated by multiplying the number of days on which physical activity was performed

by the number of minutes of activity and dividing by sixty to determine hours per week of physical activity. Analyses were performed on the square root transformation of this variable since it was considerably positively skewed.

Participants were asked to indicate if they would like to receive information on various health topics including reducing cholesterol, controlling high blood pressure, losing weight, healthy eating, exercising, and reducing stress, among others. The number of health interests indicated were summed.

Analyses

Only data provided by smokers were included in analyses. Descriptive statistics including demographics, smoking patterns, quit behaviors, smoking environment, workplace attitudes about smoking, and correlates of smoking were examined for all smokers (STATA v13). Differences in these variables were then examined by job type, controlling for age, sex, and company using generalized estimating equations (logistic regression for dichotomous outcomes and linear regression for continuous outcomes), in order to account for clustering by company. Predictive probabilities of dichotomous outcomes and predicted means of continuous outcomes were then estimated (STATA v13 Margins). Two covariance patterns were examined, exchangeable and independent, and after examination of model fit (quasi-likelihood under the independence model criterion "QIC"), the independent covariance pattern was chosen [Hardin & Hilbe, 2002].

To identify subgroups of smokers based on their smoking patterns, smoking environments, quit behaviors, and correlates of smoking, a latent class analysis (LCA) was performed (SAS v9.2, proc LCA). LCA creates a latent variable, representing subgroups of participants, using variables that were directly measured. In order to develop the latent variable, all of the directly measured variables were categorized in order to ensure sufficient cell sizes for each category in the analysis. Dichotomized variables (yes, no) included quit attempts in the past 12 months; addiction; past use of a formal quit-smoking program, nicotine replacement therapy, or cessation medications; smokeless tobacco use; and talked to a doctor about quitting in the past 12 months. Trichotomized variables included cigarettes per day (1–3, 4–10, or 11–80), self-efficacy to quit (0–4, 5–7, or 8–10), and physical activity (0–2, >2 to 7, >7 hr per week). Four categories were defined for proportions of friends and coworkers who smoke (more than half, about half, less than half, or almost none/none); support to quit from family, friends, co-workers, and management (1–2, 3, 4, and 5); time since last routine doctor or dentist visit (1, 2, 5, or >5 years); interest in health topics other than smoking (none, 1, 2–3, or >=4); and job stress (0–1, 2–3, 4–5, 6–8). Finally, five

categories were defined for perceived stress (0–3, 4–5, 6–7, 8–9, or >=10). Estimation was requested and converged for 2, 3, and 4 groups. The 2-group solution resulted in one large and one small group, the 3-group solution split the larger group of the 2-group solution, and in the 4-group solution ambiguous assignments (e.g., probabilities close to 0.5 between two groups) were more prevalent; therefore, three groups were chosen.

After the latent variable was developed, analysis of variance (SAS v9.2) was used to describe the distribution of smoking patterns, quit behaviors, smoking environment, workplace attitudes about smoking, and correlates of smoking over the three subgroups identified, adjusting for age, sex, and company as a random effect. Simple *t*-tests for differences of the variables between members of the latent classes were examined. To determine whether job type was related to these ordered latent classes, a generalized linear model was used with a cumulative logit link, adjusting for age, sex, and company as a random effect. The inverse link was used to give predicted prevalences and predicted (adjusted) numbers in the cross-tabulation of latent class by job type, conditional on the number in each job type. A χ^2 test of independence in the 6×3 table ($df = 10$) is reported.

RESULTS

Table I outlines the demographic characteristics, smoking patterns, quit behaviors, smoking environment, workplace attitudes about smoking, and correlates of smoking for the manufacturing workers who were current smokers ($n = 713$). The smokers were predominantly male (79%), white (84%), and production workers (70%). A majority were daily smokers (85%), over half indicated evidence of addiction (56%), 11% were smokeless tobacco users in addition to cigarette smokers, and 64% reported considering quitting in the next 6 months.

Production workers (P) had higher prevalences of characteristics regarded a priori as less favorable to cessation than managers (M), production managers (P/M), support staff (Su), research and development or engineering (R&D/E), or sales staff (Sa), controlling for age, sex, and company ($n = 708$) (Table II). For example, they had the highest prevalence of daily smoking (88% (P) vs. 68% (M), 84% (P/M), 78% (Su), 63% (R&D/E), and 68% (Sa) ($P = 0.050$ for the overall group difference)) and addiction (61% (P) vs. 26% (M), 50% (P/M), 48% (Su), 29% (R&D/E), and 28% (Sa) ($P < 0.001$)). They were the most likely to indicate that half or more of their close friends smoke (62% (P) vs. 41% (M), 54% (P/M), 44% (Su), 28% (R&D/E), and 37% (Sa) ($P < 0.001$)) and that half or more of their coworkers smoke (44% (P) vs. 31% (M), 37% (P/M), 20% (Su), 16% (R&D/E), and 18% (Sa) ($P < 0.001$)). They had the lowest mean support to quit from friends (3.8 (P) vs. 4.1 (M), 4.1 (P/M),

TABLE 1. Characteristics of Employees at 47 Small Manufacturing Companies in the Twin Cities, Minnesota Who Are Current Smokers (n = 713)

Variable	N	Percent or median (min–max)
<i>Demographics</i>		
Age	693	42 (18–73)
Male sex	713	79%
White race	713	84%
More than high school education	713	55%
<i>Job type</i>		
Manager	708	4%
Production manager		13%
Production		70%
Support		8%
Research and development or Engineering		2%
Sales		3%
<i>Smoking patterns</i>		
Daily smoker	713	85%
Cigarettes per day	684	10 (.03*–80)
Addicted	684	56%
Smokeless tobacco user	702	11%
<i>Quit behaviors</i>		
Quit attempt, past 12 months	700	63%
Talked with doctor about quitting, 12 months	705	26%
Considering quitting, 6 months	689	64%
Self-efficacy to quit	709	6 (0–10)
Past use of any cessation aids	690	47%
Past use of nicotine replacement therapy	675	38%
Past use of cessation medication	661	26%
Past use of formal quit-smoking program	647	8%
<i>Smoking environment</i>		
Household member smokes	704	48%
Half or more close friends smoke	707	57%
Half or more coworkers smoke	701	40%
Support to quit		
Family	676	5 (1–5)
Friends	676	4 (1–5)
Coworkers	668	3 (1–5)
Company management	650	4 (1–5)
<i>Workplace attitudes about smoking</i>		
Most or all coworkers support those trying to quit	709	36%
Most or all coworkers think smoking is a bad habit	706	46%
<i>Correlates of smoking</i>		
Perceived stress	704	6 (0–16)
Job stress	678	3 (0–8)
Risky alcohol use	648	20%
> 1 year since last routine doctor visit	644	46%
> 1 year since last routine dentist visit	664	49%
Physical activity, hours per week	681	4 (0–31.5)
Number of health interests	713	2 (0–9)

Addicted refers to the proportion who smoked their 1st cigarette within 30 min of waking; *self-efficacy to quit* has a possible range of 0–10 with higher scores indicating greater self-efficacy; *support to quit* has a possible range of 1–5 with higher scores indicating greater support; *perceived stress* has a possible range of 0–16 with higher scores indicating greater stress; *job stress* has a possible range of 0–8 with higher scores indicating greater job stress; *risky alcohol users* included women who averaged more than one drink per day and men who averaged more than two; *number of health interests* is the sum of health topics that participants would like to receive information about.

*The minimum cigarettes smoked per day was less than one because nondaily smokers were included in this analysis.

TABLE II. Differences in Characteristics of Employees at 47 Small Manufacturing Companies in the Twin Cities, Minnesota Who are Smokers by Job Type (n = 708)

Variable	N	Percent or mean (SE)						P-value
		Manager (n = 25)	Production manager (n = 96)	Production (n = 495)	Support (n = 55)	R&D or Engineering (n = 16)	Sales (n = 21)	
<i>Smoking patterns</i>								
Daily smoker	690	68%	84%	88%	78%	63%	68%	0.050
Cigarettes per day	667	11.2 (2.41)	13.2 (0.98)	12.7 (0.46)	10.5 (1.50)	7.3 (2.03)	8.8 (1.56)	0.040
Addiction	665	26%	50%	61%	48%	29%	28%	<0.001
Smokeless tobacco user	681	5%	11%	11%	11%	8%	3%	0.120
<i>Quit behaviors</i>								
Quit attempt, past 12 months	680	62%	59%	61%	84%	86%	80%	<0.001
Talked to doctor about quitting, 12 months	679	36%	32%	26%	31%	0%*	28%	0.623
Considering quitting, 6 months	668	58%	67%	63%	72%	73%	74%	0.282
Self-efficacy to quit	687	7.1 (0.72)	6.0 (0.25)	6.0 (0.13)	7.2 (0.35)	7.1 (0.69)	7.5 (0.62)	0.007
Past use of any cessation aids	669	56%	57%	44%	53%	48%	47%	0.153
Past use of nicotine replacement therapy	654	40%	44%	35%	42%	39%	44%	0.388
Past use of cessation medication	638	42%	33%	22%	36%	20%	31%	0.095
Past use of formal quit-smoking program	642	17%	8%	7%	10%	0%*	0%*	0.464
<i>Smoking environment</i>								
Household member smokes	682	53%	52%	49%	41%	37%	26%	0.087
Half or more close friends smoke	686	41%	54%	62%	44%	28%	37%	<0.001
Half or more coworkers smoke	680	31%	37%	44%	20%	16%	18%	<0.001
<i>Support to quit</i>								
Family	659	4.6 (0.20)	4.4 (0.14)	4.4 (0.05)	4.8 (0.08)	4.7 (0.18)	4.7 (0.16)	<0.001
Friends	660	4.1 (0.25)	4.1 (0.11)	3.8 (0.05)	4.3 (0.12)	4.4 (0.18)	4.3 (0.20)	<0.001
Coworkers	652	3.9 (0.25)	3.9 (0.12)	3.4 (0.07)	4.0 (0.16)	3.8 (0.23)	3.4 (0.33)	<0.001
Company management	636	4.2 (0.23)	4.1 (0.12)	3.6 (0.10)	4.4 (0.15)	3.7 (0.29)	3.7 (0.28)	<0.001
<i>Workplace attitudes about smoking</i>								
Most or all coworkers support those trying to quit	688	56%	43%	32%	46%	41%	55%	0.007
Most or all coworkers think smoking is a bad habit	686	78%	52%	43%	44%	71%	37%	<0.001
<i>Correlates of smoking</i>								
Perceived stress	684	4.9 (0.50)	5.6 (0.33)	6.4 (0.17)	5.6 (0.39)	5.8 (.94)	5.3 (0.57)	0.028
Job stress	658	2.0 (0.43)	2.5 (0.16)	3.6 (0.08)	3.7 (0.27)	3.3 (.23)	3.3 (0.23)	<0.001
Risky alcohol use	633	13%	20%	21%	16%	35%	9%	0.240
>1 year since last routine doctor visit	626	43%	43%	47%	51%	52%	41%	0.950
>1 year since last routine dentist visit	646	18%	50%	53%	42%	51%	56%	<0.001
Physical activity, hours per week	664	4.0 (0.94)	5.9 (0.53)	6.1 (0.29)	5.4 (.60)	5.2 (1.0)	5.5 (1.4)	0.347
Number of health interests	690	2.7 (0.46)	2.4 (0.17)	2.3 (0.13)	2.6 (0.24)	1.4 (0.44)	2.0 (0.55)	0.276

Analyses are adjusted for age, sex, and company. *P*-value is for an overall group difference.

Addicted refers to the proportion who smoked their 1st cigarette within 30 min of waking; *self-efficacy to quit* has a possible range of 0–10 with higher scores indicating greater self-efficacy; *support to quit* has a possible range of 1–5 with higher scores indicating greater support; *perceived stress* has a possible range of 0–16 with higher scores indicating greater stress; *job stress* has a possible range of 0–8 with higher scores indicating greater job stress; *risky alcohol users* included women who averaged more than one drink per day and men who averaged more than two; *number of health interests* is the sum of health topics that participants would like to receive information about.

4.3 (Su), 4.4 (R&D/E) and 4.3 (Sa) ($P < 0.001$)) and were the least likely to indicate that most or all coworkers support those trying to quit (32% (P) vs. 56% (M), 43% (P/M), 46% (Su), 41% (R&D/E), and 55% (Sa) ($P = 0.007$)). Further, they had the highest mean level of perceived stress (6.4 (P) vs. 4.9 (M), 5.6 (P/M), 5.6 (Su), 5.8 (R&D/E), and 5.3 (Sa) ($P = 0.028$)).

The LCA identified 3 subgroups of smokers, Fewest Barriers, Some Barriers, and Greatest Barriers to cessation (Table III). Members of the Fewest Barriers group had the most favorable characteristics for smoking cessation. They had the highest self-efficacy to quit; were the least likely to indicate that half or more of their coworkers smoke; reported the highest support to quit from family, friends, coworkers,

TABLE III. Results from the Latent Class Analysis: Identified Subgroups of Employees at 47 Small Manufacturing Companies in the Twin Cities, Minnesota Who Are Current Smokers ($n = 713$)

Variable	Percent or Mean (SE)		
	Fewest Barriers ($n = 231$)	Some Barriers ($n = 253$)	Greatest Barriers ($n = 229$)
<i>Smoking patterns</i>			
Daily smoker	78% ^a	83% ^a	94% ^b
Cigarettes per day	11.0 (0.62) ^a	11.9 (0.66) ^a	14.2 (0.65) ^b
Addiction	53% ^a	51% ^a	63% ^a
Smokeless tobacco user	7% ^a	14% ^a	10% ^a
<i>Quit behaviors</i>			
Quit attempt, 12 months	67% ^{a,b}	68% ^a	54% ^b
Talked with doctor about quitting, 12 months	25% ^a	34% ^b	20% ^a
Considering quitting, 6 months	69% ^a	68% ^a	56% ^b
Self-efficacy to quit	7.1 (0.20) ^a	6.5 (0.16) ^b	5.0 (0.17) ^c
Past use of any cessation aids	43% ^a	52% ^a	45% ^a
Past use of nicotine replacement therapy	34% ^a	43% ^a	35% ^a
Past use of cessation medication	25% ^a	29% ^a	23% ^a
Past use of formal quit-smoking program	5% ^a	12% ^b	6% ^{a,b}
<i>Smoking environment</i>			
Household member smokes	51% ^a	39% ^b	54% ^a
Half or more close friends smoke	47% ^a	53% ^a	72% ^b
Half or more coworkers smoke	26% ^a	39% ^b	53% ^c
Support to quit			
Family	5.0 (0.02) ^a	4.7 (0.04) ^b	3.6 (0.10) ^c
Friends	4.9 (0.03) ^a	4.1 (0.04) ^b	2.7 (0.06) ^c
Coworkers	4.9 (0.03) ^a	3.4 (0.06) ^b	2.4 (0.05) ^c
Company management	4.9 (0.04) ^a	3.7 (0.10) ^b	2.7 (0.11) ^c
<i>Workplace attitudes about smoking</i>			
Most or all coworkers support those trying to quit	62% ^a	32% ^b	15% ^c
Most or all coworkers think smoking is a bad habit	56% ^a	43% ^b	39% ^b
<i>Correlates of smoking</i>			
Perceived stress	5.3 (0.19) ^a	6.1 (0.22) ^b	7.1 (0.15) ^c
Job stress	2.9 (0.15) ^a	3.6 (0.14) ^b	3.6 (0.12) ^b
Risky alcohol use	20% ^a	19% ^a	21% ^a
>1 year since last routine doctor visit	60% ^a	51% ^b	50% ^{a,b}
>1 year since last routine dentist visit	53% ^a	54% ^a	41% ^b
Physical activity, hours per week	6.6 (0.42) ^a	5.8 (0.41) ^a	5.5 (0.34) ^a
Number of health interests	2.1 (0.18) ^a	2.5 (0.10) ^a	2.4 (0.20) ^a

Analyses are adjusted for age, sex, and company. ^{a,b,c}Values within a row that share the same letter are not statistically significantly different ($P > 0.05$). *Addicted* refers to the proportion who smoked their 1st cigarette within 30 min of waking; *self-efficacy to quit* has a possible range of 0–10 with higher scores indicating greater self-efficacy; *support to quit* has a possible range of 1–5 with higher scores indicating greater support; *perceived stress* has a possible range of 0–16 with higher scores indicating greater stress; *job stress* has a possible range of 0–8 with higher scores indicating greater job stress; *risky alcohol users* included women who averaged more than one drink per day and men who averaged more than two; *number of health interests* is the sum of health topics that participants would like to receive information about.

TABLE IV. Identified Subgroups of Employees at 47 Small Manufacturing Companies in the Twin Cities, Minnesota Who are Current Smokers by Job Type (n = 708)

	N (%)						P-value
	Manager (n = 25)	Production manager (n = 96)	Production (n = 495)	Support (n = 55)	R&D or Engineering (n = 16)	Sales (n = 21)	
LCA group							0.010
Fewest Barriers	13.7 (55%)	42.9 (45%)	151.2 (31%)	31.5 (57%)	9.7 (60%)	8.8 (42%)	
Some Barriers	7.9 (32%)	34.0 (35%)	188.6 (38%)	16.3 (30%)	4.5 (28%)	7.6 (36%)	
Greatest Barriers	3.4 (13%)	19.1 (20%)	155.2 (31%)	7.2 (13%)	1.8 (12%)	4.6 (22%)	

Analyses are adjusted for age, sex, and company. Numbers of employees are predicted, rather than observed. *P*-value is for 6 job-types relating to 3 latent classes from a generalized linear model (χ^2 test with 10 df).

and company management; were the most likely to indicate that most or all of their coworkers support those trying to quit and think that smoking is a bad habit; and had the lowest levels of perceived stress and job stress. Members of the Some Barriers group were the most likely to have talked with a doctor about quitting in the past 12 months and least likely to have a household member who smoked. However, overall they had less favorable characteristics for smoking cessation compared to the Fewest Barriers group, including lower self-efficacy to quit, higher likelihood to indicate that half or more coworkers smoke, less support to quit from family, friends, coworkers, and company management, lower likelihood to state that most or all of their coworkers support those trying to quit or think that smoking is a bad habit, and higher perceived stress and job stress.

The Greatest Barriers group had the least favorable characteristics for smoking cessation. For example, they had the highest prevalence of daily smoking; were the least likely to be considering quitting in the next 6 months, most likely to indicate that half or more of their close friends or coworkers smoke, and the least likely to indicate that most or all of their coworkers support those trying to quit; and had the highest perceived stress level. Production workers (Table IV) were the most likely to be represented in the Greatest Barriers group (31% (P) vs. 13% (M), 20% (P/M), 13% (Su), 12% (R&D/E), and 22% (Sa) ($P = 0.010$)).

DISCUSSION

This study examined smoking patterns, quit behaviors, smoking environment, workplace attitudes about smoking, and correlates of smoking in smokers employed at small manufacturing companies in the Minneapolis and St. Paul metro area, MN. As expected, we found that production workers appear to have higher prevalence of smoking and overall smoking environments, smoking patterns, and quit behaviors that are less favorable to cessation compared to

workers with other job types. This is consistent with previous findings that blue-collar workers have smoking characteristics that are less conducive to quitting when compared to white-collar workers [Giovino et al., 2000; Barbeau et al., 2004] However, previous findings were limited to differences in prevalence, cessation, age of initiation, and intensity of smoking (number of cigarettes smoked per day) and therefore, these findings significantly expand knowledge in this area.

An additional finding is that production managers represent a distinct group of employees who should not be categorized with either managers or production workers in terms of their smoking behaviors and characteristics. Production managers share similarities with both managers and production workers but also have distinct smoking behaviors and characteristics. For example, production managers were similar to managers in their past use of any cessation aids and support for quitting from friends, coworkers, and company management; similar to production workers in their smokeless tobacco use, self-efficacy to quit, risky alcohol use, and time since last routine dentist visit; and had values for addiction, proportion of close friends who smoke, perceived workplace attitudes about smoking, and stress that were distinct from both managers and production workers. In addition, we found smoking prevalence among managers to be lower than previous estimates (11% vs. 16%) [National Center for Health Statistics, 2013]. This is likely due to the exclusion of production managers from the manager job type. Production managers had a much higher smoking prevalence than individuals who described themselves solely as managers (26% vs. 11%). This finding further demonstrates the importance of distinguishing between these job types.

Limitations of this study include our focus on manufacturing workers from the Minneapolis and St. Paul metro area, Minnesota and our sample being predominately male (79%) and white (84%), which limits the generalizability of these findings to other populations.

However, other studies that have focused on manufacturing workers have also found a majority of male and white workers [Emmons et al., 1994; Sorensen et al., 2003; Hunt et al., 2007; Brehm et al., 2011]. An additional limitation of this study is that we decided not to conduct pairwise comparisons when examining the smoking behaviors and characteristics by job type. We made this decision due to the small sample sizes among the managers ($n=25$), research and development or engineering ($n=16$), and sales workers ($n=21$) and the likelihood that we would not be able to detect statistically significant differences between these groups. Given that the aims of this paper are descriptive, we decided to instead provide a *P*-value for the overall group difference as a guide indicating whether these job types have differences in smoking behaviors and characteristics. Another limitation is our reliance on self-report to determine smoking status without biochemical validation, such as cotinine measurement. However, studies have found self-reported smoking status to be reasonably accurate, with the largest issue being underreporting of smoking [Patrick et al., 1994; Gorber et al., 2009; Wong et al., 2012]. It is unlikely that underreporting of smoking was a large issue in this study, given that we found slightly higher smoking prevalence than previous studies among manufacturing workers (27% vs. 24%) [National Center for Health Statistics, 2013]. These limitations are unlikely to have differentially impacted smoking characteristics among workers of different job types.

The findings of this study and the fact that smaller worksites face challenges in offering worksite wellness programs, [Linnan et al., 2008; Harris et al., 2014] reinforce the conclusion that manufacturing workers at small companies represent a group that is in need of health promotion efforts, specifically smoking cessation promotion. Interventionists could leverage the particular advantages that small companies have for implementing workplace health programs including fewer hierarchical layers, which facilitates policy or program changes, a more intimate work culture that can facilitate participation in health programs, and more visible management who can serve as health promoters [Harris et al., 2014].

Interventionists could utilize these findings to develop targeted interventions for employees who are at the highest risk of continued smoking. Individuals in the Greatest Barriers group had the least favorable characteristics for smoking cessation, including high levels of daily smoking and stress and low levels of support for quitting. Therefore individuals in this group face additional challenges to cessation compared to workers in the Some and Fewest Barriers to cessation groups. Interventionists could use the findings from the LCA to identify groups that are at the greatest risk of continued smoking, such as groups that share similarities to the

Greatest Barriers group, and tailor intervention efforts to these groups. Although production workers were the most likely to be represented in the Greatest Barriers group (31%), 20% of production managers and 22% of sales workers were also included in this group. Therefore, cessation efforts that solely target production workers may fail to aid all manufacturing workers who are at the highest risk of continued smoking.

Future directions for this study include determining whether job type or number of barriers (based on LCA subgroup membership) is associated at 12-month follow-up with 1) quitting smoking and/or 2) awareness of and responsiveness to the Wellness Works integrated workplace safety and smoking cessation intervention.

ACKNOWLEDGMENTS

The authors thank members of the Wellness Works staff, Marc Katz, Claudia Egelhoff, Sarah Haas, and Kari Scanlon; consultant, Mary Kay Hunt; and all of the worksites that participated in the project. Grant sponsor: National Institute on Drug Abuse at the National Institutes of Health; Grant number: R01DA029092. Grant sponsor: National Cancer Institute at the National Institutes of Health; Grant number: R25CA163184.

AUTHORS CONTRIBUTION

E. Pinsker has substantial contributions to the conception of the work, analysis, and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. D. Hennrikus has substantial contributions to the conception of the work, acquisition and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. P. Hannan has substantial contributions to the analysis and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. H. Lando has substantial contributions to the conception of the work, interpretation of data for the work; revising the work critically for important intellectual content; final

approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. L. Brosseau has substantial contributions to the acquisition of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

- Ayyagari P, Sindelar JL. 2010. The impact of job stress on smoking and quitting: Evidence from the HRS. *BE J Econ Anal Poli* 10(1): 1–30.
- Barbeau EM, Krieger N, Soobader MJ. 2004. Working class matters: Socioeconomic disadvantage, race/ethnicity, gender, and smoking in NHIS 2000. *Am J Public Health* 94(2):269–278.
- Borland R, Owen N, Hill D, Schofield P. 1991. Predicting attempts and sustained cessation of smoking after the introduction of workplace smoking bans. *Health Psychol* 10(5):336–342.
- Brehm BJ, Gates DM, Singler M, Succop PA, D'Alessio DA. 2011. Environmental changes to control obesity: A randomized controlled trial in manufacturing companies. *Am J Health Promot* 25(5):334–340.
- Breslau N, Peterson E, Schultz L, Andreski P, Chilcoat H. 1996. Are smokers with alcohol disorders less likely to quit? *Am J Public Health* 86(7):985–990.
- Brisson C, Larocque B, Moisan J, Vezina M, Dagenais G. 2000. Psychosocial factors at work, smoking, sedentary behavior, and body mass index: A prevalence study among 6995 white collar workers. *J Occup Environ Med* 42(1):40.
- Bryant J, Bonevski B, Paul C, O'Brien JO, Oakes W. 2011. Developing cessation interventions for the social and community service setting: A qualitative study of barriers to quitting among disadvantaged Australian smokers. *BMC Public Health* 11(493):1–8.
- Centers for Disease Control and Prevention. 2009. Behavioral Risk Factor Surveillance System. Available at: <http://www.cdc.gov/brfss/questionnaires.htm>. (Accessed 15 Aug 2013).
- Centers for Disease Control and Prevention. 2010. Workplace Safety & Health Topics: Occupational Health Supplement of the National Health Interview Survey 2010. Available at: <http://www.cdc.gov/niosh/topics/nhis/manufacturing/manufig15b.html>. (Accessed 1 August 2013).
- Centers for Disease Control and Prevention. 2012. Current cigarette smoking among adults—United States, 2011. *MMWR* 61(44):889–894.
- Cohen S, Williamson G. 1988. Perceived stress in a probability sample of the U.S. In: Spacapan A, Oskamp S, editors. *The social psychology of health: Claremont symposium on applied social psychology*. California: Newbury Park.
- deRuiter WK, Faulkner G, Cairney J, Veldhuizen S. 2008. Characteristics of physically active smokers and implications for harm reduction. *Am J Public Health* 98(5):925–931.
- Egelhoff C, Katz M, Brosseau L, Hennrikus D. In Press. Creating a representative sample of small manufacturing businesses for an integrated workplace safety and smoking cessation intervention study. *J Occup Environ Med*.
- Emmons KM, Marcus BH, Linnan L, Rossi JS, Abrams DB. 1994. Mechanisms in multiple risk factor interventions: Smoking, physical activity, and dietary fat intake among manufacturing workers. *Prev Med* 23:481–489.
- Falk DE, Yi HY, Hiller-Sturmhöfel S. 2006. An epidemiologic analysis of co-occurring alcohol and tobacco use disorders: Findings from the national epidemiologic survey on alcohol and related conditions. *Alcohol Res Health* 29(3):162–171.
- Farkas A, Pierce J, Zhu S, Rosbrook B, Gilpin E, Berry C, Kaplan R. 1996. Addiction versus stages of change models in predicting smoking cessation. *Addiction* 91:1281–1292.
- Fiore MC, Jaén CR, Baker TB, Bailey WC, Benowitz NL, Curry SJ, Dorfman SF, Froelicher ES, Goldstein MG, Heaton CG, et al. 2008. *Treating tobacco use and dependence: 2008 update*. U.S. Department of Health and Human Services. Rockville, MD: Public Health Service.
- Giovino G, Pederson L, Trosclair A. 2000. The prevalence of selected cigarette smoking behaviors by occupational class in the United States. *Work, smoking, and health: A NIOSH scientific workshop*. Washington DC: Centers for Disease Control and Prevention. pp. 22–31.
- Gorber SC, Schofield-Hurwitz S, Hardt J, Levasseur G, Tremblay M. 2009. The accuracy of self-reported smoking: A systematic review of the relationship between self-reported and cotinine-assessed smoking status. *Nicotine & Tob Res* 11(1):12–24.
- Green KL, Johnson JV. 1990. The effects of psychosocial work organization on patterns of cigarette smoking among male chemical plant employees. *Am J Public Health* 80:1368–1371.
- Hardin JW, Hilbe JM. 2002. *Generalized estimating equations*. New York: Chapman & Hall/CRC.
- Harris JR, Hannon PA, Beresford SA, Linnan LA, McLellan DL. 2014. Health promotion in smaller workplaces in the United States. *Annu Rev Public Health* 35:327–342.
- Hartmann-Boyce J, Stead LF, Cahill K, Lancaster T. 2013. Efficacy of interventions to combat tobacco addiction: Cochrane update of 2012 reviews. *Addiction* 108:1711–1721.
- Hays JT, Schroeder DR, Offord KP, Croghan IT, Patten CA, Hurt RD, Jorenby DE, Fiore MC. 1999. Response to nicotine dependence treatment in smokers with current and past alcohol problems. *Ann Behav Med* 21(3):244–250.
- Heatherton TF, Kozlowski LT, Frecker RC, Fagerström KO. 1991. The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. *Br J Addict* 86(9):1119–1127.
- Hughes JR. 1995. Clinical implications of the association between smoking and alcoholism. In: Fertig J, Allen JP, editors. *Alcohol and tobacco: From basic science to clinical practice*. Washington DC: U.S. Government Printing Office. pp. 171–181.
- Hughes JR, Keely JP, Niaura RS, Ossip-Klein DJ, Richmond RL, Swan GE. 2003. Measures of abstinence in clinical trials: Issues and recommendations. *Nicotine Tob Res* 5:13–26.
- Hunt MK, Stoddard AM, Kaphingst KA, Sorensen G. 2007. Characteristics of participants in a cancer prevention intervention designed for multiethnic workers in small manufacturing worksites. *Am J Health Promot* 22(1):33–37.
- Hyland A, Borland R, Li Q, Yong HH, McNeil A, Fong GT, O'Connor RJ, Cummings KM. 2006. Individual-level predictors of cessation behaviors among participants in the International Tobacco Control (ITC) Four Country Survey. *Tob Control* 15:83–94.
- Kaczynski AT, Manske SR, Mannell RC, Grewal K. 2008. Smoking and physical activity: A systematic review. *Am J Health Behav* 32(1):93–110.

- Karasek R, Brisson C, Kawakami N, Houtman I, Bongers P, Amick B. 1998. The Job Content Questionnaire (JCK): An instrument for internationally comparative assessments of psychosocial job characteristics. *J Occup Health Psychol* 3(4):322–355.
- Kassel J, Stroud L, Paronis C. 2003. Smoking, stress, and negative affect: Correlation, causation, and context across stages of smoking. *Psychol Bull* 129(2):270–304.
- Kottke TE, Battista RN, DeFries GH, Brekke ML. 1988. Attributes of successful smoking cessation interventions in medical practice. A meta-analysis of 39 controlled trials. *JAMA* 259(19):2883–2889.
- Lancaster T, Stead L, Silagy C, Sowden A. 2000. Effectiveness of interventions to help people stop smoking: Findings from the Cochrane Library. *BMJ* 321:355–358.
- Lawhon D, Humfleet GL, Hall SM, Reus VI, Muñoz RF. 2009. Longitudinal analysis of abstinence-specific social support and smoking cessation. *Health Psychol* 28(4):465–472.
- Lee DJ, Fleming LE, Arheart KL, LeBlanc WG, Caban AJ, Chung-Bridges K, Christ SL, McCollister KE, Pitman T. 2007. Smoking rate trends in U.S. occupational groups: The 1987–2004 National Health Interview Survey. *J Occup Environ Med* 49(1):75–81.
- Linnan L, Bowling M, Childress J, Lindsay G, Blakey C, Pronk S, Wieker S, Royall P. 2008. Results of the 2004 National Worksite Health Promotion Survey. *Am J Public Health* 98(8):1503–1509.
- Mackenzie TD, Pereira RI, Mehler PS. 2004. Smoking abstinence after hospitalization: Predictors of success. *Prev Med* 39(6):1087–1092.
- Monsó E, Campbell J, Tønnesen P, Gustavsson G, Morera J. 2001. Sociodemographic predictors of success in smoking intervention. *Tob Control* 10(2):165–169.
- National Cancer Institute. 2003. Tobacco Use Supplement to the Current Population Survey. Available at: <http://appliedresearch.cancer.gov/tus-cps/>. (Accessed June 2009).
- National Center for Health Statistics. 2013. Current smokers: Estimated prevalence by current occupation, U.S. working adults aged 18 and over, 2004–2011. Available at: http://wwwn.cdc.gov/eworld/Data/Current_smokers_Estimated_prevalence_by_current_occupation_US_working_adults_aged_18_and_over_20042011/60. (Accessed 3 Dec 2014).
- National Institute on Alcohol Abuse and Alcoholism. 2014. Rethinking Drinking: Alcohol and your health. Available at: <http://rethinkingdrinking.niaaa.nih.gov/IsYourDrinkingPatternRisky/WhatsAtRiskOrHeavyDrinking.asp>. (Accessed Jan 2014).
- Patrick DL, Cheadle A, Thompson DC, Diehr P, Koepsell T, Kinne S. 1994. The validity of self-reported smoking: A review and meta-analysis. *Am J Public Health* 84(7):1086–1093.
- Pronk NP. 2013. Integrated worker health protection and promotion programs: Overview and perspectives on health and economic outcomes. *J Occup Environ Med* 55(12 Suppl):S30–S37.
- Reitzel LR, Nguyen N, Eischen S, Thomas J, Okuyemi KS. 2014. Is smoking cessation associated with worse comorbid substance use outcomes among homeless adults? *Addiction* 109(12):2098–2104.
- Ribisl KM, Reischl TM. 1993. Measuring the climate for health at organizations: Development of the worksite health climate scales. *J Occup Med* 35(8):812–824.
- Richmond R, Kehoe L, Webster I. 1993. Multivariate models for predicting abstinence following intervention to stop smoking by general practitioners. *Addiction* 88:1127–1135.
- Sapp AL, Kawachi I, Sorensen G, LaMontagne AD, Subramanian SV. 2010. Does workplace social capital buffer the effects of job stress? A cross-sectional, multilevel analysis of cigarette smoking among U.S. manufacturing workers. *J Occup Environ Med* 52(7):740–750.
- Satre DD, Kohn CS, Weisner C. 2007. Cigarette smoking and long-term alcohol and drug treatment outcomes: A telephone follow-up at five years. *Am J Addiction* 16:32–37.
- Schulte PA, Pandalai S, Wulsin V, Chun H. 2012. Interaction of occupational and personal risk factors in workforce health and safety. *Am J Public Health* 102(3):434–448.
- Senore C, Battista RN, Shapiro SH, Segnan N, Ponti A, Rosso S, Aimar D. 1998. Predictors of smoking cessation following physicians counseling. *Prev Med* 27:412–421.
- Smith DR, Leggat PA. 2007. Tobacco smoking by occupation in Australia: Results from the 2004–2005 National Health Survey. *J Occup Environ Med* 49(4):437–445.
- Sorensen G, Stoddard A, Hammond SK, Hebert JR, Avrunin JS, Ockene JK. 1996. Double jeopardy: Workplace hazards and behavioral risks for craftpersons and laborers. *Am J Health Promot* 10(5):355–363.
- Sorensen G, Stoddard AM, LaMontagne AD, Emmons K, Hunt MK, Youngstrom R, McLellan D, Christiani DC. 2003. A comprehensive worksite cancer prevention intervention: Behavior change results from a randomized controlled trial. *J Public Health Policy* 24(1):5–25.
- Tindle HA, Shiffman S. 2011. Smoking cessation among intermittent smokers versus daily smokers. *Am J Public Health* 101(7):e1–e3.
- United States Census Bureau. 2010. Statistics of U.S. Businesses. Available at: <http://www.census.gov/econ/sub/>. (Accessed 27 Oct 2013).
- United States Department of Labor. 2014. Bureau of Labor Statistics. Available at: <http://www.bls.gov/ces/tables.htm#ee>. (Accessed 6 May 2014).
- Walker JF, Loprinzi PD. 2014. Longitudinal examination of predictors of smoking cessation in a national sample of U. S. adolescent and young adult smokers. *Nicotine Tob Res* 16(6):820–827.
- Walsh DC, Jennings SE, Mangione T, Merrigan DM. 1991. Health promotion versus health protection? Employees' perceptions and concerns. *J Public Health Policy* 12(2):148–164.
- Wen CP, Wai JP, Tsai MK, Yang YC, Cheng TY, Lee MC, Chan HT, Tsao CK, Tsai SO, Wu X. 2011. Minimum amount of physical activity for reduced mortality and extended life expectancy: A prospective cohort study. *Lancet* 378(9798):1244–1253.
- Wong SL, Shields M, Leatherdale S, Malaison E, Hammond D. 2012. Assessment of validity of self-reported smoking status. *Health Reports* 23(1):47–54.
- Yap TL, Davis LS, Gates DM, Hemmings AB. 2009. The effect of tailored e-mails in the workplace. *AAOHN J* 57(7):267–273.

All work was performed at the University of Minnesota.

Disclosure Statement: The authors report no conflicts of interests.