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Smokeless Tobacco Use Among Operating Engineers

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Abstract

Purpose—Workers in blue collar occupations have been shown to have higher rates of smokeless tobacco (ST) use compared to other occupational groups. Guided by the Health Promotion Model, the purpose of this study was to understand various factors that predict ST use in Operating Engineers.

Methods—A cross-sectional design was used to determine variables related to ST use among Operating Engineers. Engineers (N=498) were recruited during their three-day apprentice certification course to participate in the study. Logistic regression was used to assess the associations between personal, psychological and behavioral characteristics associated with ST use.

Results—Past month ST use was reported among 13% of operating engineers surveyed. Multivariate analysis showed that younger age and lower rates of past month cigarette use were significantly associated with ST use, while higher rates of problem drinking were marginally associated with ST use.

Conclusions—Operating Engineers, are at high risk for using ST products with rates in this sample well over the national average. Work site interventions, which have shown promise in other studies, may be useful in decreasing ST use among this population.

Keywords

Smokeless Tobacco; Addiction; Tobacco; Health Behaviors

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I am currently a postdoctoral fellow at the University of Michigan School of Nursing. I am interested in alternative tobacco use (smokeless tobacco use, waterpipe/hookah use) and the relationship of these tobacco use methods to conventional cigarette use and other substance use.

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Declaration of Interest
None to declare.

Introduction

Tobacco use is the leading preventable cause of death in the United States (U.S.) and is responsible for an estimated 438,000 deaths, or 1 out of 5 deaths annually (Centers for Disease Control and prevention [CDC], 2005, 2006). Smokeless tobacco (ST) use carries many risks similar to cigarette smoking including nicotine addiction, exposure to a large array of toxic chemicals, risk for heart diseases and oral cancers (Henely, Thum, Connell & Calle, 2005; Lee, 2007; Muwonge et al., 2008; Piano et al., 2010). An estimated 8.1 million people in the United States use ST (Substance Abuse and Mental Health Services {SAMHSA}, 2008). Unlike cigarette use which has been declining (Tomar 2010a; Piano et al., 2010), the use of ST products, including snuff and chewing tobacco, have remained relatively stable over the past ten years at about 4.4% in 2000 and 4.3% in 2005 (Rodu & Cole, 2009).

Workers in blue collar occupations in particular have been shown to have higher rates of ST use compared to other occupational groups, such as white collar workers (SAMPSA, 2008; Lee et al., 2007). In 2005, the prevalence of ST among blue collar workers was 5.6% compared to 1.6% in white collar occupations (Lee et al., 2007). Although some studies have focused on ST use in blue collar workers, very few have focused specifically on Operating Engineers (those responsible for operating heavy equipment such as bulldozers and cranes). Using the Health Promotion Model (HPM) as a guide (Pender, Murdaugh & Parsons, 2010), this study will report personal, psychological and behavioral characteristics that explain ST use among Operating Engineers. The major concepts of the HPM focus on personal (biological, socio-cultural), psychological and behavioral characteristics (past related behaviors) that explain behavior (Pender, Murdaugh & Parsons, 2010). The personal (age, race, marital status, and educational level), psychological (depression) and behavioral factors (cigarette use, alcohol use, physical activity, BMI and sleep) that may influence ST use are presented below.

Personal Factors and Psychological Factor Related to Smokeless Tobacco Use

Age, sex, race/ethnicity, marital status, educational level and area of residence have all been shown to be associated with ST use. Adult ST users are more likely to be younger, male, white, have lower education levels, work in blue collar occupations, live in the South or Midwest, live in small metro areas, and live in rural areas (SAMHSA, 2008; Lee et al., 2007; Nelson et al., 2006; Rodu & Cole, 2009). Depression, a psychological factor has been associated with ST use, with ST users reporting higher rates of depressive symptoms (Smith, Ferucci, Dillard & Lanier, 2010; Coogan, Geller & Adams, 2000).

Behavioral Factors Related to Smokeless Tobacco Use

Smokeless tobacco use has also been associated with cigarette use (Backinger et al., 2008; Rodu & Cole, 2009; Tomar, Alpert & Connelly, 2010). Daily ST users have the lowest prevalence of daily smoking (Tomar et al., 2010). Furthermore, cigarette smoking prevalence among these men increased with decreased ST use. Rodu and Cole (2009) reported similar results with one-third of ST users also using cigarettes, and dual users (both cigarette and ST users) consuming significantly fewer cigarettes on average than those that used cigarettes exclusively.

Smokeless tobacco use has also been associated with risky alcohol use (Accort, Waterbor, Beall & Howard, 2002; Ary et al., 1989; Engstorm, Magnusson & Galanti, 2010; Kao, Schnider & Hoffman, 2000; Padãro, Silva Matos, Damasceno & Lumet, 2010). Falk and colleagues (2006) examined the relationship between tobacco use (cigarettes, ST and cigars) and alcohol use and found that approximately 20% of U.S. adults use both alcohol and

tobacco. Engstorm and colleagues (2010) found an association between risky alcohol consumption, binge drinking and ST use.

Cigarette smoking has been linked to physical inactivity (Engstorm et al., 2010; Kaczynski, Manske, Mannell, & Grewal, 2008), although interestingly, many studies have reported no association between physical inactivity and ST use (Engstorm et al., 2010; Henely et al, 2005; Lando et al., 1999). This may be related to measurement differences as well as occupational differences (Engstorm et al., 2010; Henely et al., 2005). Furthermore, studies have reported inconsistent results examining the relationship of ST use and BMI readings, with ST use being associated with both higher and lower BMI readings (Engstorm et al., 2010; Henely et al., 2005; Shukla, Gupta, Mehta, & Hebert, 2002; Vander Weg, Klesges & DeBon, 2005). Finally, sleep disturbances have been associated with cigarette use and poor health behavior although few studies have examined the association of sleep disturbances and ST use (Phillips and Danner, 1995). Overall, the relationship between health behaviors and ST use has not been studied among Operating Engineers.

Methods

Design, Sample and Procedure

A cross-sectional design was used to determine variables related to ST use among Operating Engineers. The dependent variable was past month smokeless tobacco use. The explanatory variables included personal factors (age, sex, marital status, race and educational level), one physiological factor (depression), and behavioral factors (cigarette use, alcohol intake, BMI, physical activity and sleep). Human subject approval was obtained from the University of Michigan. Consent was implied with reading the provided information and returning the survey.

The sampling frame included approximately 12,000 Operating Engineers in the state of Michigan participating in either a three-day apprentice certification course for new Operating Engineers or the 8-hour Hazardous Materials (Hazmat) refresher course. All courses were provided by the Operating Engineers Local 324 during the winter of 2008. Engineers were recruited from the classes to participate until a quota of 500 participants was obtained. The sample size quota of 500 participants was for feasibility purposes because data collection only occurred over one winter as well as to assure adequate power for less prevalent risk behaviors in this population. The instructors of the courses explained the study to the participants, passed out the study packets and collected completed surveys in a sealed envelope. Participation was voluntary and engineers received a $10 gasoline gift card for completing the survey.

Almost all, (90%) of the Operating Engineers who were asked to participate agreed and returned the survey. Two of the surveys returned were incomplete and dropped from the analysis, resulting in a final sample of 498. The sample, described in detail elsewhere, (Duffy et al., 2010) had a mean age of 41, was predominately male and Caucasian.

Measures

Dependent Variable—Self- report smokeless tobacco use was determined based on use in the past thirty days. Participants were first asked if they had used tobacco products in the past month. Participants were then asked to check the type to tobacco used in the past month from a list including cigarette use, snuff/chewing tobacco use, cigar use, pipe use, and cigarillo use. All those that selected ST use were assumed to have used in the past month.

Independent Variables

Personal Factors and Psychological Factors: Demographic information including age, sex, race/ethnicity, marital status and educational level were collected from all participants. The well validated Center for Epidemiologic Studies Depression Scale (CES-D), a 20 item self-report scale that measured various symptoms of depression in community populations was used to measure depression in this study (Radloff, 1977). Scores range from zero to 60 with a cut-off score of 16 indicating probable depression (Radloff, 1977). Internal consistency ranged from .84 to .87 across ethnicities (Crockett et al., 2005; Radloff, 1977).

Behavioral Factors: Self-report cigarette use was determined the same way past month smokeless tobacco use was determined. All participants that had used tobacco in the past month were asked to check the type to tobacco used in the past month from a list including cigarette use, snuff/chewing tobacco use, cigar use, pipe use, and cigarillo use. All those that selected cigarette use were assumed to have used in the past month. All those that selected cigarette use were assumed to have used in the past month and were coded as yes, all others as no. Participants were also asked to report in whole numbers the number of cigarettes smoked per day.

The Alcohol Use Disorder Identification Test (AUDIT), a 10 item self-report scale that measures amount of alcohol use, frequency of alcohol use, alcohol dependence and alcohol related problems were used to measure risky drinking behavior (Babor, Higgins-Biddle, Saunders & Monteiro, 2001). The possible range of scores was from zero to 40 with a cut-off point of eight indicating problem drinking (Babor et al., 2001). High internal consistency of the measure has been reported in studies examining various populations (Babor et al., 2001).

The Physical Activity Questionnaire, a six item survey that assesses time spent, duration and intensity of various activities including occupational activity was used to measure physical activity (Norman, Bellocco, Bergstm, & Wolk, 2001). A physical activity score is based on the duration and intensity of the activities reported over a one year time period. The test-retest reliability was .65 in a group of over 100 men, and criterion validity has been reported to be high (Norman et al., 2001). Body Mass Index (BMI), was calculated based on dividing self-reported weight by self-reported height squared multiplied by the conversion factor of 703 (CDC, 2011). Finally sleep was measured by the well validated Medical Outcomes Study (MOS) sleep scale, a six item questionnaire measuring quality and quantity of sleep (Hayes et al., 2005). Scores range from zero to 100 with higher scores indicating better sleep quality. The internal consistency of the scales ranged from .63 to .73 (Hayes et al., 2005).

Data Analysis

Data was analyzed using Statistical Package for Social Sciences, PAWS version 18. Descriptive statistics, chi-square tests and independent t-tests were used to determine the bivariate relationships. Multivariate, logistic regression was used to determine the associations between the independent variables and ST use; due to power constraints, only those variables that showed promise in the bivariate analyses were included in the multivariate analysis. The multivariate analysis was also examined accounting for possible clustering among the classes that were used for recruiting. There were no differences in the analysis results so the clustering variable was not included in the final model. Values of $p < 0.05$ were considered to be significant.

Results

Forty-four percent (n=206) of the sample reported current tobacco use. Twenty-nine percent (n=142) reported current cigarette use and 13% (n=66) reported current ST use. Fifteen percent (n=10) of smokeless tobacco users also used cigarettes The bivariate associations between the independent variables and ST use are presented in Table 1. Compared to non-smokeless tobacco users, users were more likely to be younger (p=.002), be male (p=.012), be less likely to have smoked cigarettes in the past month (p=.010) and had a lower mean number of cigarettes smoked per day (p=.027). Smokeless tobacco users had higher alcohol intake compared to non-smokeless tobacco users although this difference was not significant (41% vs. 31%). Although not significant, depression rates were high among both ST users and non-users (48.4% vs. 46.6%).

The multivariate associations between the independent variables and ST use are presented in Table 2. Age was significantly associated with ST use, with each year increase in age, Operating Engineers were 5% less likely to use ST (*OR*=.951, *95% CI*= .925–.982, p=.002). Sex was not significant probably due to lack of power, but in the expected direction as none of the 37 women in the study used ST. Past month cigarette use was also significant; those who had smoked cigarettes in the past month were 60% less likely to use ST (*OR*=.402, *95% CI*= .191–.849, p=.017). Problem drinking approached significance; those who screened positive for problem drinking were 1.6 times more likely to use ST (*OR*= 1.67, *95% CI*= .937–2.98, p=.082).

Discussion

Thirteen percent of the entire sample of Operating Engineers reported past month smokeless tobacco use. This is over three times the national average, and more than double the use rate of other blue collar workers reported in the literature (Lee et al., 2007; Rodu & Cole, 2009). Similar to other studies, the smokeless tobacco users in this study were more likely to be younger and male (Nelson et al., 2006; Lee et al., 2007; Rodu & Cole, 2009; SAMPSA, 2007). Educational level was not associated with ST use. Smokeless tobacco use rates have been disproportionately higher in lower educated populations (Nelson et al., 2006; Rodu & Cole, 2009), although these studies did not analyze only blue collar workers, who on the whole, have lower educational levels.

Past month cigarette use was associated with decreased smokeless tobacco use. Many studies have also reported a similar relationship between ST use and cigarette use (Rodu & Cole, 2009; Tomar et al., 2010). Other studies have demonstrated an increase in poly-tobacco use (concurrent ST use and cigarette use) among young adults. This poly-tobacco use should be explored further, because ST users are more likely to be younger and therefore may be more at risk for polytobacco use (Backinger et al., 2008; Tomar et al., 2010).

While the association between problem drinking and ST use only approached significance in this study, other studies have supported the link between ST use and problem drinking (Engstorm et al., 2010; Padãro et al., 2010). The combination of alcohol and tobacco use increases the risk of head and neck cancers (Hashibe et al., 2009) which are common among Operating Engineers (Boffetta et al., 2003). Moreover, those with problem drinking have a harder time quitting tobacco use (Leeman et al., 2008). Coupling smokeless tobacco prevention/cessation initiatives with interventions geared towards decreasing alcohol consumption may be efficacious in this population.

Research has reported the association of smokeless tobacco use and depression with ST users reporting higher depressive symptoms (Smith et al., 2010). Yet, there were no differences in depression rates among ST users and non-users. Depression rates among both

the ST users and non-users in this study were over 40%, this is almost double population norms reported in the literature which are approximately 21% (Radloff, 1977). Depression often impedes behavior change (Onyike et al., 2003; Roberts et al., 2003) and treatment for depression among those that are ST users may increase motivation to stop using ST.

Limitations

This was cross-sectional study, causality between age, cigarette use, and problem drinking and the dependent variable of ST use cannot be assumed. While the sample was relatively large, the sample was recruited from convenience sample of primarily Caucasian Operating Engineers in Michigan which limits generalizability. Finally, although self-report smoking status is reliable, biological endpoints including serum cotinine is the superior way to measure tobacco use behavior (Gorber, Schofield-Hurwitz, Hardt, Levasserur & Tremblay, 2009).

Conclusion

The rates of ST use among Operating Engineers in Michigan are about triple population norms. Those who are younger, male, and screen positive for drinking appear to be at higher risk for using ST. Work site interventions, which have been shown to have promise in other studies for health behavior change (Harely et al., 2010; Sorensen et al., 2007), may be useful in decreasing ST use among operating engineers.

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Table 1

Bivariate Associations of Independent Variables and Smokeless Tobacco Use Status

Variable	**Past Month ST Users (N=66) Frequency (%)**	**ST Non-users (N=432) Frequency (%)**	***P*-value**
Sex			
Male	66 (100%)	379 (91.1%)	.012*
Female	0 (0%)	37 (8.9%)	
Race			
White	62 (96.9%)	374 (91.7%)	.144
Non-white	2 (3.1%)	34 (8.3%)	
Educational Level			
High school or less	44 (66.7%)	251 (58.1%)	.296
College or more	22 (33.3%)	168 (38.9%)	
Married			
Yes	45 (68.2%)	284 (65.7%)	.948
No	21 (31.8%)	135 (31.3%)	
Past month cigarette use			
Yes	10 (15.2%)	132 (30.6%)	.010*
No	56 (84.8%)	300 (69.4%)	
AUDIT (Problem Drinking)			
Yes	27 (41.5%)	129 (31.4%)	.105
No	38 (58.5%)	282 (68.6%)	
CES-D (Depression)			
Yes	31 (48.4)	189 (46.6)	.779
No	33 (51.6)	217 (53.4)	
Variable	Past Month ST Users (N=66) Mean (SD)	ST Non-users (N=432) Mean (SD)	*P*-value
Age	39.6 (9.5)	43.4 (9.2)	.002*
Number of Cigarettes Smoked a Day	11.4 (7.3)	20.6 (12.8)	.027*
MOS Sleep Scale	69.9 (20.3)	70.3 (16.8)	.853
Physical Activity Score	42.3 (5.1)	42.6 (5.3)	.416
BMI	30.4 (5.4)	30.2 (5.8)	.763

* $p < 0.05$

Data do not always sum to total sample size because of missing data
Percentages are based on total for each category and may not always total 100 due to rounding

Table 2

Multivariate Analysis of Independent Variables Associated with Smokeless Tobacco Status

Variable	Odds Ratio	95% CI	*P*-Value
Age	.951	.922–.981	.002 *
Sex (Male =1)	5.06	.660–38.75	.119
Past Month Cigarette Use (Yes = 1)	.402	.191–.849	.017 *
AUDIT (ETOH Problem)	1.67	.937–2.98	.082
Race (White = 1)	1.78	.398–8.03	.448
Education (High school or less= 1)	1.44	.797–2.62	.224

* = $p<0.05$