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Factors Associated With Risky Sun Exposure Behaviors Among Operating Engineers

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Abstract

Background—The objective of this study was to determine the factors associated with sun exposure behaviors among Operating Engineers (heavy equipment operators).

Methods—Operating Engineers (N=498) were asked to complete a cross-sectional survey. Linear and logistic regression analyses were used to determine health behavior, perceptional, and demographic factors associated with sun exposure behavior (sun burns, blistering, use of sunscreen, and interest in sun protection services).

Results—Almost half reported 2 or more sunburns/summer and the median times blistering was 2 with a range of 0–100. About one-third never used sun block while just over one-third rarely used sun block. Almost one-quarter were interested in sun protection guidance. Multivariate analyses showed that perceptions of skin type, alcohol problems, fruit intake, BMI, sleep quality, age, sex, and race were significantly associated with at least one of the outcome variables ($p<.05$).

Conclusions—Operating Engineers are at high risk for skin cancer due to high rates of exposure to UV light and low rates of sun block. Subgroups of Operating Engineers are particularly at risk for sun damage. Interventions are needed to decrease sun exposure among Operating Engineers.

Keywords

Sun exposure; Sunburn; Sunscreens; Sun protection; Worksite interventions

INTRODUCTION

Skin cancer is one of the most common cancers in the United States resulting in 10,850 deaths annually (Jemal et al., 2010). The incidence of skin cancer has increased, and an

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estimated two million new cases of non-melanoma skin cancer (e.g., basal cell and squamous cell carcinoma) were diagnosed in 2010 (Jemal et al., 2010; Leiter et al., 2008). In addition, the rates of melanoma are on the rise with an increase of cases by 3.1% annually since 1992 among non-Hispanic Caucasians (American Melanoma Foundation, 2009). The causes of skin cancer include increased sun exposure, exposure to ultraviolet (UV), outdoor activities, changes in clothing style, increased longevity, ozone depletion, as well as genetics (Leiter et al., 2008). Among these causes, exposures to sunlight and UV play a pivotal role in developing skin cancer and even influence mortality (Leiter et al., 2008; Mona et al., 2004; Xu et al., 2009; Berwick et al., 2005).

Outdoor workers are particularly exposed to high UV levels compared to indoor workers (Diffey et al., 2009; Gies et al.. 2007; Thieden, 2004) and are thus at greater risk of developing skin cancer. However, the rates of receiving skin examination and the use of sun protection are lower among outdoor workers compared to indoor workers (LeBlanc et al., 2008; Woolley et al., 2002). Moreover sunscreen, which protects against sunburn and the subsequent development of skin cancers (Bodekær et al., 2008; Darlington et al., 2003), is used by less than half of outdoor workers appropriately (Shoveller et al., 2000). Since few studies have examined the sun exposure-related variables among outdoor workers, an understanding of their sun-related characteristics may help to develop sun protection interventions. Therefore, the purpose of this study was to determine demographic, perceptional and health behavioral factors associated with risky sun exposure behaviors among Operating Engineers. Given the idea that poor health behaviors bundle together (Chiolero et al., 2006; National Institutes of Health, 2009; Schuit et al., 2002), risky sun exposure behaviors were hypothesized to be positively related to other poor health behaviors.

METHODS

Design/Sample

This study cross-sectional survey was conducted in 2008 to measure the health habits of Operating Engineers. Human studies approval was received from the University of Michigan. Since the survey was anonymous, informed consent, which would have identified participants, was not required. Operating Engineers were given the health behavior survey while they attended a training course offered by the Operating Engineers Local 324. Operating Engineers were enlisted to participate during the winter of 2008 until a quota of 500 participants was reached which was more than enough power for the analyses to be conducted. Due to incompletion of two of the surveys, they were dropped from the analysis, which resulted in a final sample size of 498. Of those asked to participate, 90% agreed and returned the survey. Participants who completed the survey received a $10 gasoline gift card.

Measures

Dependent Variables—At the time of the study, there were no well-known, published measures of sun exposure. Therefore, sun exposure was assessed using selected questions from a survey used to assess the sun safety behaviors of postal workers (Oh et al., 2004). The first question asked: In an average summer, how many times do you get a sunburn (0, 1, 2, 3, 4 or more times)? The second question asked: About how many times in your life do you recall having had a sunburn severe enough to cause your skin to blister (write in number)? The third question asked: On the days when you are outside in the sunlight, how often do you use sunblock (never, some of the time, about half the time, most of the time, always)? The last question asked: Would you be interested in receiving health services for sun protection guidance (yes/no)?

Independent Variables—For descriptive purposes, Operating Engineers were asked: In general, during the summer week days, about how many hours a day are you outside between 10 am and 3 pm? and, In general, during the summer holidays and weekends, about how many hours a day are you outside between 10 am and 3 pm (less than an hour, 1 to 2 hours, 2 to 3 hours, 3 to 4 hours, 4–5 hours)? Perceived susceptibility was measured by the question: Which best describes how your skin generally reacts to the sun when you're not using any sun protection (always burn-unable to tan, usually burn-then can tan if I work at it, sometimes mild burn-then tan easily, rarely burn-tan easily)? Since poor health habits have been shown to cluster together (Chiolero et al., 2006; National Institutes of Health, 2009; Schuit et al., 2002), questions were asked about related behaviors including smoking, problem drinking, diets, physical activity and sleep quality. Smoking including both cigarettes and other tobacco products was classified into current versus former/never smokers. Problem drinking was measured by the well-known Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al., 1993). To briefly assess diet, selected questions from the validated Willett food frequency questionnaire (Willett et al., 1985) were used; respondents provided the average number of servings of fruit and vegetables they ate over the past year. The Willett food frequency questionnaire has been validated in both men and women (Feskanich et al., 1993, Rimm et al., 1992, Salvini et al., 1989) and extensively used in studies relating dietary intake to other relevant lifestyle behaviors (smoking, alcohol use) (Stryker et al., 1988). Physical activity during the previous year was assessed using a validated survey (Norman et al., 2001) that assesses time spent doing different types of activities, including type of occupational activity, and creates a total physical activity score based on the duration and intensity of the activities reported. Self-reported height and weight were used to determine body mass index (BMI; weight in kilograms divided by the square of height in meters). Sleep was assessed using validated questions from the Medical Outcomes Study (MOS) (Hays et al., 2005). Psychological status was measured using the well validated Center for Epidemiologic Studies/Depressed Mood Scale (CES-D) (Radloff, 1977). Medical comorbidities were measured using a validated self-report instrument (Mukerji et al., 2007) and used in the analyses as number of medical comorbidities. Standard questions on demographics were asked including age, sex, race, marital status, and educational level.

Data Analysis

Descriptive statistics were computed for all variables. Bivariate analyses (not shown) were conducted to determine collinearity between independent variables; since fruit and vegetable intake were highly correlated, only fruit intake was included in the multivariate analyses. Linear and logistic regression multivariate analyses were used to determine the association between perceived skin type, health behaviors, and demographic factors with sunburning, blistering, use of sun block, and interest in sun protection guidance. Since all of the respondents did not answer all of the questions, the sample size varied for different results. Those with missing data for a particular question were not included in the analysis. Values for $p<0.05$ are reported.

RESULTS

Sample

The description of the sample can be found in table 1. Over 80% reported spending 4–5 hours in the sun during weekdays and about two-thirds spent 4–5 hours in the sun on weekends. About three quarters reported that they sometimes burn or rarely burn and tan easily. Yet almost half reported 2 or more sunburns/summer and the median times blistering was 2 with a range of 0 to 100. About one-third never used sun block while just over one-third rarely used sun block. Almost one-quarter were interested in sun protection guidance.

Over 40% smoked, and about one-third screened positive for problem drinking. Over half ate 4 or less fruits/week and just under half ate 4 or less vegetables/week. Over 84% were either overweight or obese, the mean physical activity score was about average, while the mean sleep score was just under average. Almost half screened positive for depressive symptoms, and about half had 1 or more medical comorbidities. The average age of the Operating Engineers was 42.9, and most were white. About two-thirds were married and had a high school education or less.

Multivariate Analyses

Four regression models were constructed, and independent variables were identical across the four models (Table 2). All the four regression models were significant at the level of .05 and explained 13 to 27% of variance in sun-related variables. Perceptions of skin type, alcohol problems, fruit intake, BMI, sleep quality, age, sex, and race were significantly associated with at least one of the outcome variables among Operating Engineers. Perceived skin type, BMI, and physical activity were significantly associated with sunburns among Operating Engineers. Those who perceived their skin type as either always to usually burning (p=.000) or sometimes burning (p=.000) were more likely to have sun burns compared to those who perceived their skin as rarely burning. Higher BMIs (p=.011) and higher levels of physical activity (p=.048) were related to more sun burns. In addition, perceptions of skin type as either always to usually burning (p=.000) or being sometimes burning (p=.000), alcohol problems (p=.037), BMI (p=.013), age (p=.001), and white race (p=.009) were positively related to blistering, while sleep quality (p=.043) was negatively associated. Those who perceived their skin as either always to usually burning (p=.000) or sometimes burn (p=.000) compared to rarely burning more alcohol problems (p=.025), greater fruit consumptions (p=.001), and females (p=.000) were more likely to use sun block. Perceived skin type and age were significantly associated with interest in sun protection services. When compared to those who perceived their skin type being rarely burning, those who perceived their skin type being always to usually burning had 2.73 times greater odds of interest in sun protection services (OR = 2.73, 95% CI 1.23, 6.08, p = .014). For additional year of age, Operating Engineers had 1.03 times greater odds of interest in skin protection services (OR = 1.03, 95% CI 1.00, 1.07, p = .043). Depressive symptoms were significant with sunburns and blisters in bivariate analyses, but were no longer significant in multivariate analyses.

DISCUSSION

The majority of the Operating Engineers indicated high rates of sun exposure, with an average of 4–5 hours spent in the sun both on weekdays and weekends suggesting that this population is at high risk for sun damage. Perceived skin type was significantly associated with all four of the dependent variables including sunburns, blistering, use of sun block, and interested in receiving health services for sun protection guidance. While those who perceived their skin type as more likely to burn were more likely to use sun block, they still reported more sun burns and blistering than those who perceived themselves more likely to tan. This suggests that perceived susceptibility to burning results in recognition of the problem and subsequent action, it does not necessarily result in less sun burning and blistering.

About one-third of this population screened positive for problem drinking compared to about 7–13% depending in the general population (Substance Abuse and Mental Health Services Administration, 2009) and those who screened positive for problem drinking were more likely to report blistering. This may because alcohol intake itself may increase the severity of sunburn (Warthan et al., 2003). Another explanation might be that those under

the influence of alcohol may have decreased cognitive ability and less sensation to recognize when they are burning to the point of blistering.

Consistent with a previous study (Dennis et al., 2008), those with a greater BMI also reported more sun burning and blistering and over 80% of this population reported being overweight and obese. The high rates of sun burning and blistering among those with greater BMI's may be due to large body size exposed to sun and greater difficulty in covering all areas of the skin. Another explanation for the increased sun exposure risk among those who screen positive for problem drinking as well as those with high BMI levels may be due to the fact that those who engage in one risky behavior are likely to engage in other risky behaviors as well (Schuit et al., 2002). At the same time, those who engage in positive health behaviors are more likely to adopt other positive health behaviors. Hence, those with higher fruit intake were more likely to use sun block, albeit fruit and vegetable intake overall were low in this population. By the same token, those with better sleep quality were less likely to blister, which is a new contribution to the literature.

On the other hand, those with higher physical activity levels, a positive health behavior, were more likely to sun burn perhaps due to greater exposure to outdoor activities. Smoking rates were high and smoking is generally associated with poor health habits including sun burning (Saraiya, 2002), problem drinking (Chiolero et al., 2006), low intake of fruits and vegetables (Schuit et al., 2002), poor physical activity (Kvaavik et al., 2004), and less sleep (Zhang et al., 2006), however, smoking was not significant in any of the sun-related models in this study.

While depression rates were high and depression is commonly associated with poor health habits, it was not significant in any of the sun-related models nor was the number of medical comorbidities. The association with some of the demographic factors to the dependent variables was consistent with the literature in that those who were older reported more lifetime blistering and greater interest in receiving sun protection guidance, women were more likely to use sun block than men (Saraiya, 2002), and whites were more likely to be sensitive to sunburn and report blistering than non-Whites (McCool et al., 2009). While the literature reports that those of higher educational level have a better understanding of ways to protect themselves from the sun (Saraiya, 2002), educational level was not significant in any of the sun-related models in this study perhaps because there was little variation in educational levels among the Operating Engineers. Moreover marital status, which has also been shown to be associated with sun burning (Saraiya, 2002), was not significant in any of the sun-related models in this study.

Overall, these data support the need for sun protection interventions among Operating Engineers. Targeted screening has been proven to be effective in detecting melanoma and precancerous lesions (Swetter et al., 2003). Early detection improves the prognosis and the opportunity to improve survival (Mona et al., 2004). Therefore, skin examinations of this population by physicians should be performed on a regular basis, so that skin problems and risks of skin cancer are evaluated and treated in an early stage.

Behavioral interventions have also been shown to improve sun protection among outdoor workers. These include placing messages all over the worksite about sun protection (Buller et al., 2005), taking a photo of the faces of participants that exposed UV damage as well as a video discussing the cancerous effects of UV exposure and sun protection methods (Stock et al., 2009), and text message reminders of the weather report and a reminder to put on sunscreen (Armstrong et al., 2009). Community campaigns have helped change the perceptions related to tans and importance of sun protection (Roberts et al., 2009) and mandatory sun protection policies with related consequences for not following the protocol

were also found to be effective in worksites (Woolley et al., 2008). Given that multiple health behavior interventions could be more effective than single behavior interventions (Prochaska, 2008), multiple health behavior interventions addressing risky sun exposure behavior as well as other poor health behaviors simultaneously (such as problem drinking, diet, physical activity, and BMI) may be useful among Operating Engineers of which almost one quarter were interested in sun protection services.

There were several limitations to the study. This was a cross-sectional study and did therefore not account for changes over time. Data was based on self-report and there were no clinical observations made to corroborate the responses. While a question was asked about use of sun block, other questions about sun protection, such as plentiful water intake, the use of hats and protective clothing (Madgwick et al., 2011), were not included on the survey. Although perceived skin type was measured, there are many sun exposure measures, such as skin type, pigmentation, sun sensitivity, high number of melanocytic naevus, the presence of clinically atypical naevus, and the history of skin cancer that were not measured in this preliminary study of the health habits of Operating Engineers. In addition, occupational sun exposure versus non-occupational sun exposure was not determined, however, hours of exposure to the sun on weekdays and weekends were included as descriptive variables. The Willett food frequency questionnaire may result in recall bias and misclassification bias, albeit these biases are likely to attenuate the associations towards the null (Willett, 1998).

In conclusion, Operating Engineers are at high risk for skin cancer due to high rates of exposure to UV light and low rates of sun block use among this population. Subgroups of Operating Engineers are particularly at risk for sun damage. Interventions are needed to decrease sun exposure among Operating Engineers.

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Table 1

Description of the Sample of Operating Engineers (N=498)

	N	Percentage
In an average summer, how many times do you get a sunburn? (n=484)		
0	66	13.6
1	176	36.4
2	131	27.1
3 or more times	103	22.9
How many times have you had a sunburn severe enough to cause blisters? (n=453)		
0	134	29.1
1	174	37.8
3 or more	152	33.0
How often do you use sunblock? (n=483)		
Never	178	36.9
Some of the time	187	38.1
About Half of the time	53	11.0
Most of the time/Always	68	14.1
Would you be interested in Sun Protection Guidance (n=422)	96	22.8
How does your skin usually react to the sun? (n=481)		
Always burn, unable to tan	20	4.2
Usually burn, then can tan if I work at it	93	19.3
Sometimes mild burn, then easily tan	230	47.8
Rarely burn, tan easily	138	28.7
Smoking (n=487)	217	44.6
Alcohol Problem (AUDIT ≥8 and drank in past 1 year, n=476)	156	32.8
Servings of Fruit (not counting juices) (n=485)		
None to 2–4 per week	266	54.8
5–6 per week or more	219	45.2
Servings of Vegetables (not counting salad or potatoes) (n=485)		
None to 1 per week	85	17.5
2–4 per week	122	25.2
5–6 per week	90	18.6
1 per day or more	188	38.8
Depressed (n= 470)	220	46.8
Medical comorbidities (n= 482)		
None	239	49.6
1 or more	243	50.4
Sex (n=482)		
Male	445	92.3
Female	37	7.7
Race (n=472)		
White	436	92.4

	N	Percentage
Non-white	36	7.6
Marital Status (n=485)		
Married	329	67.8
Not Married	156	32.2
Educational Level (n=485)		
High School or Less	295	60.9
Some College or More	190	39.1
	Mean (SD)	Range
Physical activity (n= 472)	42.7 (5.3)	29.1 – 61.5
BMI (n=478)	30.3 (5.8)	17.5–58.3
Sleep quality (n=487)	70.3 (17.4)	0–100
Age (n=476)	42.9 years (9.4)	18–70 years

Table 2

Multivariate Models Predicting Sunburns, Blistering, Use of Sunblock, and Interest in Services for Sun Protection

Variable	Sunburns		Blistering		Use of Sunblock		Interest in Services	
	Beta	p-value	Beta	p-value	Beta	p-value	OR	p-value
Perceived Skin								
Always to Usually burn	**.602**	**.000**	**.343**	**.000**	**.305**	**.000**	**2.730**	**.014**
Sometimes burn	**.317**	**.000**	**.252**	**.000**	**.121**	**.038**	1.284	.512
Rarely burn	0		0		0		1	
Smoking	−.039	.401	.023	.644	−.089	.078	.871	.648
Alcohol Problem	.077	.095	**.107**	**.031**	**.115**	**.022**	.978	.944
Fruit Intake	−.008	.861	.005	.920	**.180**	**.000**	1.238	.469
BMI	**.110**	**.020**	**.137**	**.007**	−.005	.926	1.025	.331
Physical Activity	**.092**	**.048**	−.025	.618	−.044	.379	1.017	.536
Sleep Quality	−.027	.584	**−.107**	**.046**	−.040	.468	.994	.508
Depressive Symptoms	.045	.359	.071	.170	−.030	.568	1.129	.699
Number of Medical Comorbidities	−.030	.539	−.062	.236	−.066	.218	1.051	.742
Age	.000	.998	**.177**	**.001**	−.010	.853	**1.034**	**.043**
Sex (Female)	.034	.477	.071	.161	**.197**	**.000**	1.711	.321
White	−.004	.930	**.152**	**.002**	−.061	.224	.531	.358
Married	−.019	.683	.034	.492	.045	.373	.639	.149
High School or Less	.035	.441	.043	.367	−.009	.857	.999	.997
Adjusted R^2	.267		.190		.133			