Safety and Health at Work 7 (2016) 208–212

Contents lists available at ScienceDirect

Safety and Health at Work

journal homepage: www.e-shaw.org

Original Article

Outdoor Workers' Use of Sun Protection at Work and Leisure

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ARTICLE INFO

Article history:
Received 15 September 2015
Received in revised form
18 January 2016
Accepted 27 January 2016
Available online 16 February 2016

Keywords:
construction
occupational health
skin cancer
sun safety

ABSTRACT

Background: Outdoor workers are at risk of high ultraviolet radiation exposure, and may have difficulty using sun protection. The objectives were to determine the prevalence of sun protection behaviors in a sample of outdoor construction workers, and to assess which factors predict better sun protection practices.

Methods: Participants were recruited via construction unions. Workers answered a questionnaire on demographics, skin cancer risk, sun protection behaviors, and job. Sun protection behavior scores (from questions on sunscreen use, sleeved shirt, hat, shade seeking, sunglasses) were calculated by converting Likert-scale answers to scores from 0 to 4, and taking the mean (separately for work and leisure). Determinants of sun protection behavior scores were examined for work and leisure using generalized linear models.

Results: Seventy-seven workers had complete questionnaire data (participation 98%). Sun protection behaviors used most often were hats (79% often/always) and sleeved shirts (82% often/always); least prevalent were shade-seeking (8% often/always) and sunscreen (29% often/always). For both work and leisure scores, the strongest predictor was skin type, with fairer-skinned individuals having higher sun protection behavior scores. Workers had higher scores at work than on weekends. Workplaces that required hats and sleeved shirts for safety purposes had higher protection behavior scores.

Conclusion: This high-participation rate cohort helps characterize sun protection behaviors among outdoor workers. Workers practiced better sun protection at work than on weekends, suggesting that workplace policies supportive of sun protection could be useful for skin cancer prevention in the construction industry.

1. Introduction

Nonmelanoma skin cancers (NMSC) are the most common malignancies in countries with a majority of light-skinned people, including Canada [1]. The main risk factor for NMSC is excessive exposure to solar ultraviolet radiation (UVR), which is of particular concern to people who work outdoors. UVR exposure is also causally-related to cutaneous melanoma, cataract and possibly ocular melanoma [2].

A recent review of skin cancer prevention strategies in outdoor workers revealed variability in the use of protection [3]. Even within one industry (construction), the proportion of workers reporting rarely or never using sunscreen at work ranged from 25% in an Australian study [4] to 92% in a French study [5]. The most frequent protection method used by outdoor workers was sunglasses, although this may have been to prevent glare rather than for cancer prevention [3,6]. The construction industry employs the most outdoor workers of any sector in Canada [7] and is also a group that has shown less enthusiasm for practicing sun protection [8].

Occupational settings, including construction, represent a particular challenge for promoting sun safety and skin cancer

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2093-7911/$ – see front matter
http://dx.doi.org/10.1016/j.shaw.2016.01.006

prevention. A good example is provided by a study of workers who had already been treated for NMSC. Researchers found no difference in sun protection behaviors between those who worked indoors versus those who worked outdoors, even though outdoor workers' exposure was much higher, including in their leisure time [9]. The most common reason for not wearing sun protection reported was *didn't get around to putting it on*. Identifying the determinants of which sun protection behaviors are used (or not) by construction workers could lead to better defined policies for workplace prevention of skin cancer.

For the present study, data on sun protection behaviors were collected via questionnaires (demographic, work history, and task information), and these data were used to answer the following research questions:

(1) How prevalent are workplace sun protection behaviors among outdoor construction workers in British Columbia?
(2) What are the determinants of the protective behaviors identified in Question 1?

2. Materials and methods

2.1. Study design

The Outdoor Workers Project was a study that took place in summer 2013 in the Vancouver, British Columbia area (approximate latitude of 49°N). Workers filled out a questionnaire that included demographics, skin cancer risk factors, job characteristics, and sun protection behaviors undertaken while at work as well as in leisure time.

2.2. Study sample

Participants were recruited via trade unions and by approaching companies with outdoor operations via their health and safety staff. Several workers also learned about the study via word-of-mouth; some did not work in construction, but were mostly men working in male-dominated workplaces (horticulture/landscaping and wildlife protection), so they were invited to participate. Eligibility was met by those workers who were aged at least 18 years, and who spent part of an average workday outdoors. Although ideally the worker would have expected to work 5 days during their sampling week, those with more or less than 5 days scheduled were also invited to participate. All workers provided informed consent. The study protocol was approved by the University of British Columbia Research Ethics Board (certificate H11-01272).

2.3. Data collection and analytic variables

Data collection for the present study involved the use of a self-completed questionnaire. The questions were selected from a standardized set developed for measuring sun protection behaviors in outdoor workers [10]. A pilot version of the questionnaire was pretested on five workers, and modifications were made based on their feedback (mainly increased clarity on skin type and hair color descriptions).

Risk factor and demographic variables included the following: age; sex; number of hours spent outdoors between 10 AM and 4 PM on an average workday and leisure day (range, 1–6 hours); spending time in the sun to get a tan (often/always or sometimes/rarely/never); reporting more than one painful or blistering childhood sunburn (yes/no); reporting a family history of skin cancer (yes or no/don't know); skin type based on the Fitzpatrick scale [11], grouped as fair (type I and II), medium (type III) and dark (type IV or higher); eye color, grouped as light (blue, grey, or green) or dark (hazel and darker); hair color (blonde/red or brown/darker); number of sunburns in the previous summer (0, 1, or ≥ 2); and race (Caucasian or non-Caucasian). Job variables included education, industry, job title, description of tasks, and length of employment at the current job. Industry and occupation information was used to group workers into three broad categories. These were marine construction (pile driving, working on boats, dock building); land-based construction (road building and paving, concrete finishing, and residential construction); and horticultural/nonconstruction (golf course maintenance, wildlife protection, landscaping).

Data on sun protection behaviors were collected via Likert-scale answers (never, rarely, sometimes, often, always) to the questions outlined in Table 1. Questions on behaviors were asked identically but separately for work and leisure days. In addition, workers were asked how often they spent time in the sun in order to tan.

Leisure and work sun protection behavior scores were calculated by scoring each answer to the questions in Table 1 (wearing sunscreen, a sleeved shirt, a hat, sunglasses, and seeking shade) on a five-point ordinal scale ranging from 0 (never using the behavior) to 4 (always using the behavior) [12,13]. A composite score of all five behaviors was created by averaging these scores, separately for workdays (work protection behavior score) and leisure days (leisure protection behavior score), leading to scores in the range of 0 to 4.

2.4. Statistical analyses

Differences in the use of sun protection behaviors between work and leisure were tested using McNemar test to compare the proportion who often or always practiced the behavior by setting. Hours spent outdoors and the sun protection behavior scores were also compared between work and leisure time, using paired *t* tests. Multiple linear regression using SAS PROC GLM (SAS Version 9.3 for Windows; SAS Institute Inc, Cary, NC, USA) was used to model the determinants of sun protection behavior scores separately for work and leisure. Manual backwards stepwise regression was used. Explanatory variables considered for entry into the model were demographic (sex, age, race), personal risk factors (skin type, hair and eye color, having had more than one childhood sunburn, number of sunburns the previous summer, family history of skin cancer), and training and work characteristics (education, job group, job tenure). The best fit model was chosen by removing the least significant variable one by one, and leaving those variables in the model where *p*-values were below 0.2. Model results were produced as least squares means for ease of interpretation.

3. Results

Seventy-eight of 80 outdoor workers were recruited (two refused, for a participation rate of 98%). For this study, one worker

Table 1
Sun protection behavior questions from the Outdoor Workers Project questionnaire

For the following questions, think about what you do when you are outside AT WORK during the summer on a warm sunny day.
1. How often do you wear SUNSCREEN?
2. How often do you wear a SHIRT WITH SLEEVES that cover your shoulders?
3. How often do you wear a HAT?
4. How often do you stay in the SHADE or UNDER AN UMBRELLA?
5. How often do you wear SUNGLASSES?

Answers were on a five-point scale: never, rarely, sometimes, often, or always.

was excluded due to an incomplete questionnaire, leaving 77 participants. Most were male (95%), young (mean age 38 years), and Caucasian (95%; Table 2). Less than 15% identified themselves as Fitzpatrick Skin Type I or II (most susceptible to sunburn). Despite this, the majority of workers reported more than one severe childhood sunburn (58%), and nearly one third had two or more sunburns in the previous summer.

Most workers were educated (completed at least some college or trade school, 66%; Table 2), and the largest industries were marine and land-based construction (81% of all workers; Table 2). Workers had relatively long job tenure at their current position (12 years).

3.1. Sun-related behaviors at work and leisure

Sun protection behaviors at work and leisure are presented in Table 3. A majority of participants reported that, while at work, they *often or always* use sunglasses (74%), long-sleeved shirts (82%), and hats (79%). Based on data collected during on-site observations, hats were typically hardhats without a wide brim or neck flap. In contrast, few workers (8%) reported shade-seeking at work, and only 29% reported regular sunscreen use. Worksite observations indicated that sunscreen was not freely provided by any of the workplaces. Although a specific question on shirt materials was not asked on the questionnaire (i.e., whether any sun protection factor ratings applied), observations at the worksite indicated that most workers wore cotton T-shirts during this study period. In comparison to leisure protection strategies, sunscreen and sunglasses use *often or always* was similar. However, workers were more likely to wear sleeved shirts during work activities (82% compared to 62% during leisure activities, $p = 0.011$), and more likely to wear a hat (79% vs. 53% while at leisure activities, $p = 0.001$). Most workers (88%) did not often spend time in the sun in order to get a tan (Table 3).

Sun protection behavior scores and time spent outdoors at work and leisure are presented in Table 4. Overall, workers spent more time outdoors between 10 AM and 4 PM while at work than on weekends (6 hours vs. 4 hours, $p = 0.028$). Sun protection behavior scores at work were slightly higher than at leisure (2.5 vs. 2.3, $p = 0.0002$; Table 4).

Table 2
Description of participants and variables in the Outdoor Workers Project ($N = 77$)

Variable	*n* (%)
Sex	
Male	73 (95)
Female	4 (5)
Age (y)	
Mean (range)	38.0 (18–69)
Education	
High school or equivalent, or less	22 (29)
Some college, trade school, or university	24 (31)
Completed college, trade, or university	27 (35)
Prefer not to say	4 (5)
Race	
Caucasian	73 (95)
Other	4 (5)
Skin type	
I and II (very fair and fair)	11 (14)
III (white to olive)	43 (56)
IV–VI (olive to brown and darker)	23 (30)
Eye color	
Light blue, grey, or green	49 (64)
Hazel or darker	28 (36)
Hair color	
Red or blonde	9 (12)
Light brown or darker	68 (88)
Number of sunburns in the previous summer	
None	22 (29)
1	32 (42)
≥ 2	23 (30)
More than 1 severe childhood sunburn?	
Yes	45 (58)
No	32 (42)
Family history of skin cancer	
Yes	10 (13)
No or don't know	67 (87)
Job group	
Marine construction	33 (43)
Land-based construction	29 (38)
Horticultural/nonconstruction	15 (19)
Time at current job	
Mean (range)	11.8 (0.25–38)

Table 3
Frequency distributions for sun-protection behaviors for outdoor workers ($N = 77$)

Behavior	Never/rarely/sometimes (%)		Often/always (%)		*p* (McNemar test)
	Work	Leisure	Work	Leisure	
Wear sunscreen	55 (71)	55 (71)	22 (29)	22 (29)	1.0
Wear a shirt with sleeves	14 (18)	29 (38)	63 (82)	48 (62)	0.0018
Wear a hat	16 (21)	36 (47)	61 (79)	41 (53)	< 0.0001
Stay in the shade or under umbrella	71 (92)	59 (77)	6 (8)	18 (23)	0.0013
Wear sunglasses	20 (26)	17 (22)	57 (74)	60 (78)	0.366
Spend time in the sun to get a tan	–	68 (88)	–	9 (12)	–

3.2. Determinants of sun protection behavior scores

Results from determinants of behavior models (one for work, one for leisure) are presented in Table 5. In the work sun protection model, those with fairer skin types (higher risk for sunburn and skin cancer) had a higher mean protection behavior score than those with darker skin types (2.27 and 2.73 for medium and fair skin types, respectively, vs. 1.92 for darker skin). Those with light-colored eyes (higher risk) also had a higher mean work sun protection behavior score (though not statistically significant). Interestingly, light-haired workers (higher risk) had lower work sun protection behavior scores than those with darker hair (2.09 for light hair and 2.52 for darker hair); this unexpected result was marginally significant. In addition, older workers had higher work sun protection behavior scores (increase of 0.008 per year older, $p = 0.11$; results not shown). The construction workers also had higher work sun protection behavior scores than those who were not in construction, which was expected as these sites tended to require hardhats and sleeved shirts for safety reasons.

For the leisure sun protection behavior score model, similar patterns to the work score model were observed, with the strongest

Table 4
Hours spent outside, and sun protection behavior scores (work and leisure) among outdoor workers

Variable	Mean	Median	Range	*p*
Hours spent outside on workdays*	5.1	6.0	≤ 1–6	0.028
Hours spent outside at leisure*	4.2	4.0	≤ 1–6	
Workplace sun protection behavior score (range 0–4)	2.5	2.4	1.0–3.8	0.0002
Leisure time sun protection behavior score (range 0–4)	2.3	2.4	0.8–3.6	

* Between 10 AM and 4 PM (i.e., max value = 6); *p*-values are for the difference between work and leisure, first hours spent outdoors (calculated using the Wilcoxon signed-rank test), and then sun protection behavior score (calculated using the paired *t* test).

Table 5
Determinants of sun protection behavior scores

Effect	Determinants of work protection behavior score		Determinants of leisure protection behavior score	
	Mean score (SE)	*p*	Mean score (SE)	*p*
Skin type				
Fairest	2.73 (0.18)	0.0018	2.45 (0.19)	0.0024
Medium	2.27 (0.12)		1.99 (0.15)	
Darkest	1.92 (0.17)		1.65 (0.18)	
Eye color				
Blue, grey or green	2.42 (0.11)	0.1054	–	–
Brown and darker	2.20 (0.15)			
Hair color				
Blonde or red	2.09 (0.20)	0.0507	1.86 (0.21)	0.1111
Brown and darker	2.52 (0.09)		2.21 (0.11)	
Job group				
Land construction	2.41 (0.13)	0.1817	–	–
Marine construction	2.41 (0.13)		–	–
Horticultural/other	2.10 (0.18)			
Spends time in sun to tan				
Sometimes, rarely, never	–	–	2.27 (0.11)	0.0236
Often, or always			1.79 (0.21)	

Variables initially offered to the work and leisure models included those noted plus race, sex, childhood sunburn, family history of skin cancer, number of sunburns the previous summer, education, job tenure, hours spent outside at work or leisure. Skin type: fairest = Fitzpatrick Type I or II; medium = Fitzpatrick Type III; darkest = Fitzpatrick Type IV or higher. Age is also included in the model; results not shown.
SE, standard error.

relationship being with skin type (1.99 and 2.45 for medium and fair skin, respectively, compared to 1.65 for darker skin; Table 5). Eye color was not important in this model, but similar relationships with hair color and age were observed, although again, these did not reach statistical significance. Those who report spending time in the sun in order to get a tan had lower sun protection behavior scores than those who did not purposefully tan ($p = 0.02$).

In both models, race, sex, number of sunburns, childhood sunburn, or family history of skin cancer were not determining factors. Time spent outdoors at work or at leisure were also not important predictors. Job tenure was highly correlated with age (Pearson correlation coefficient = 0.75, $p < 0.0001$), so these two variables were examined in separate models; age was a stronger predictor.

4. Discussion

This study was able to study a cohort of outdoor workers to determine sun protection behavior practices practiced during work hours compared to leisure activities. The prevalence of sun protection behaviors at work by participants in this study was relatively high. The prevalence of wearing a sleeved shirt or a hat at work was both approximately 80%, which is higher than practiced during leisure activities. This is higher than reported by the only other available Canadian study with information on sun protection in outdoor workers, where 59% of men reported wearing protective clothing at work, and 62% reported covering their heads [14]. This is also higher than previously reported in construction and farming workers in other countries (50–80% reported never or rarely wearing long-sleeved shirts, for example) [3]. This is probably due to the large number of construction workers in the study who were required by their employers to wear hats and shirts for safety purposes [14]. Sunscreen use was low among men in both the current study and the NSS2 (29% and 20%, respectively). However, a recent review of outdoor workers' sun protection behaviors showed that there is wide variability in these practices across studies [3]. Shade-seeking was the least-used protective behavior at work (8% often/always); notably, workers sought shade three times more often in their leisure time, suggesting that workers may seek out shade at work if it were available.

The only statistically significant determinant of sun protection behavior score at work was skin type. However, there were suggestive relationships between the work score and eye color, hair color, job type, and increasing age. Skin type was also important for leisure time sun protection behavior scores, in addition to a propensity for tanning. Lighter skinned individuals are at higher risk of sunburn and skin cancer, and outdoor workers with lighter skin types have been found to practice better sun protective behaviors [9,15–17]. It is likely that the acute risk of sunburn for light-skinned workers is a motivator for using sun protection; public health campaigns could also be a factor driving these workers to use better protection.

Older workers had higher sun protection behavior scores at work and leisure, which is a well-known relationship in outdoor workers [17]. Among young people, especially men, there is a tendency to report less risk-averse behaviors and higher ability to cope with risk [18], which might explain why younger workers protected themselves less. In addition, there is a strong relationship with older age and a decline in the belief that tanned skin is more attractive [19], and indeed age was negatively correlated with reporting purposefully tanning (Pearson correlation coefficient = −0.27, $p = 0.014$).

Workers were less likely to wear hats and shirts on weekends, suggesting that the safety requirement for construction workers led to higher work sun protection behavior scores. An Australian study showed that outdoor workers who were required to wear sun protection had less sun-damaged skin than those who could voluntarily use sun protection provided at work [20]. Although sun protection was not the motivation behind requiring workers to wear hats and shirts at work, it may have provided sun protection as an unintended consequence.

4.1. Strengths and limitations

This study was designed to examine sun protection behaviors in a limited industry and many of the 77 participants worked for a few larger employers. This sample size and purposeful sampling strategy led to a more homogenous group, and probably contributed to the low number of discernible determinants of sun protection behaviors, even expected ones. However, it is not surprising that skin type was the strongest predictor of sun protection as this is a strong correlate of risk for both sunburn (acute) and skin cancer (chronic), and is also linked to other risk factors that did not emerge as important in the models (e.g., family history of skin cancer). The study was designed in part to contribute to the sparse Canadian literature on occupational sun exposure and protective behaviors, and the fact that it was the first study of its type meant that it was limited in size and functioned at least in part as a pilot project. This led to a smaller and more convenience-based sample of workers.

Despite these limitations, this is the first study of sun protective behaviors in Canadian construction workers, which due to wide variability in sun protection practices in outdoor workers across the world, is an important addition to the body of evidence. Focusing on the construction industry was an important part of this work, as this group has a high risk of solar UVR exposure. Of the 343,000 construction workers exposed to solar UVR in Canada, 96% are men, and over half work outdoors at least 75% of their workdays [7]. National studies of sun protection in Canadian outdoor workers have not included information on jobs, precluding the examination of differences by industry or occupation [14,21]. Future studies on sun protection and exposure in Canadian outdoor workers should be expanded to other locations (since exposure varies spatially) and industries (since different industries will have different needs for

sun protection). In addition, further contextual information on the standard questions on protective behaviors should be added in the future, such as whether or not workplaces provided sunscreen freely, what types of shirt materials were worn, and the style of hat selected, as these are important in the consideration of prevention program design, as well as in the assessment of the sun protection offered. In other words, even though most workers reported wearing a hard hat and long-sleeved shirts, these actions may not provide the best sun protection available, and so more detailed questions on clothing type and sunscreen availability would provide greater detail for the sun protection behavior scores, more in-depth context for both designing prevention programs, and better characterization of sun protection effectiveness.

This study provides evidence that outdoor workers at higher risk of sunburn and skin cancer (i.e., lighter skinned) were more likely to practice sun protection behaviors, both at work and leisure. It also showed that older workers were likely to practice protective behaviors. Workers rarely sought shade at work, but they were more likely to do so at leisure. Several practical policy implications can be identified from these findings. Firstly, although provision of shade is difficult in some outdoor workplaces, workers may be more likely to use it if it were available, given that they seek shade more often on weekends. Secondly, requiring workers to wear protective clothing could be an effective strategy for reducing sunburn and skin cancer risk. Lastly, focusing on newer/younger construction workers with sun protection messaging may be an effective way to increase their use of sun protection throughout their careers.

Conflicts of interest

The authors have no conflicts of interest to report.

Acknowledgments

We wish to acknowledge the participants of the Outdoor Workers Project and all participating companies and worksites. This project was supported through generous funding from the Canadian Dermatology Foundation. CEP was supported through fellowships from the Canadian Institutes of Health Research (CIHR) Skin Research Training Program, the Michael Smith Foundation for Health Research, and the CIHR Institute of Gender and Health.

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