Published in final edited form as:

Am J Health Promot. 2019 June ; 33(5): 683–697. doi:10.1177/0890117118814398.

Implementation of Occupational Sun Safety at a Two-year Follow-up in a Randomized Trial: Comparison of *Sun Safe Workplaces* Policy Intervention to Attention Control

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Abstract

Purpose—Implementation of employer sun safety actions was assessed in a 2-year follow-up to an occupational sun protection policy intervention.

Design—2-year follow-up assessment in a randomized pretest-posttest controlled design.

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Declaration of Conflicting Interests

Dr. Buller and Dr. Walkosz receive a salary from Klein Buendel, Inc. Ms. Mary Buller is an owner of Klein Buendel, Inc. Dr. Cutter serves on data and safety monitoring boards for AMO Pharmaceuticals, Apotek, Biolinerx Horizon Pharmaceuticals, Modigenetech/Prolor, Merck, Merck/Pfizer, Opko Biologics, Neurim, Sanofi-Aventis, Reata Pharmaceuticals, Receptos/Celgene, Teva pharmaceuticals, NHLBI (Protocol Review Committee), and NICHD (OPRU oversight committee). He is a consultant or member of advisory boards for Atara Biotherapeutics, Argenix, Genzyme, Genentech, GW Pharma, Klein-Buendel Incorporated, Medimmune, Medday, Novartis, Opexa Therapeutics, Roche, Savara Inc., Sciflour, Somahlution, Teva pharmaceuticals, and TG Therapeutics. He is President of Pythagoras, Inc. a private consulting company. Dr. Wallis, Dr. Andersen, Dr. Scott, and Dr. Meenan have no conflicts to declare.

Setting—Local government organizations with workers in public safety, public works, and parks and recreation.

Subjects—63 local government organizations (participation=64%) and 330 frontline supervisors and 1,454 workers.

Intervention—*Sun Safe Workplaces (SSW)* intervention promoting occupational sun safety policy and education.

Measures—Observations of *SSW* messages and sun safety items and surveys on organizations' communication and actions on sun safety.

Analysis—Comparison between *SSW* and control groups were conducted using regression models and adjusting for clustering where appropriate, with alpha criterion set at $p=0.05$ (two-tailed).

Results—At intervention worksites, more *SSW* messages ($p<0.001$) and sun safety items ($p=0.025$) were observed; more frontline supervisors reported organizations provided free/reduced price sunscreen ($p=0.005$) and communicated about sun safety ($p<0.001$); and more workers recalled receiving sun safety messages ($p<0.001$) and sun safety training ($p<0.001$) compared to control organizations. Implementation was greater at larger than smaller intervention organizations for wide-brimmed hats ($p=0.009$), long work pants ($p=0.017$), and shade structures ($p=0.036$). Older workers received the most written messages ($p=0.015$).

Conclusions—*SSW* appeared to produce actions by organizations to support employee sun safety. Large organizations may have processes, communication channels, and slack resources to achieve more implementation.

Keywords

skin cancer; prevention; implementation; occupational

Purpose

Outdoor workers are regularly exposed to high doses of solar ultraviolet radiation^{1–4} (UVR) increasing their risk for skin cancer,^{5–11} especially keratinocyte skin cancers (i.e., basal and squamous cell cancers) and to a lesser extent melanoma.^{12–14} Many outdoor workers are inadequately protected from UVR^{5,15–22} and U.S., Canadian, and Australian health agencies recommend that employers adopt comprehensive approaches to occupational sun protection that include administrative policies, environmental controls, and employee education^{23–32} to reduce the risk of skin cancer. Programs with policies that integrate disease prevention (i.e., improving safety of the work environment) and health promotion (i.e., wellness and chronic disease management) are considered optimal.³³

The development of policy is critical in improving chronic disease prevention and has been successful in increasing tobacco control,^{34–38} and improving physical activity and diet.^{39–41} Based on social ecological models,⁴² comprehensive worksite sun safety policies are expected to have a positive impact on occupational sun protection by motivating employers to provide training in skin cancer prevention; personal protection equipment such as

Sample

Cities, counties, and special districts in Colorado (n=98) were enrolled in the *SSW* trial.⁵⁷ Local government organizations were eligible if they had employees who worked outdoors in at least one of the following areas: public works, public safety, and parks and recreation. Also, they had to provide copies of formal written policies and have five or more senior managers complete a baseline survey to participate. Two years after the intervention concluded, key contact managers were re-contacted and invited to participate in a second follow-up assessment. Sample size was designed to provide 80% power to detect changes in policy implementation by organizations and sun safety behaviors by frontline supervisors and employees. See CONSORT diagram in Figure 1.

Measures

The measures reported in this paper include the policy measure from the baseline and first follow-up assessment and implementation measures in the second follow-up assessment: observation of sun safety messages and items by project staff and implementation of sun safety actions reported by frontline supervisors and employees.

Workplace policy adoption measure.—In the first follow-up assessment in the *SSW* trial, the primary outcome was adoption of a sun protection policy. Presence and content of policies from local government organizations were assessed by trained research assistants blind to experimental condition, using a coding protocol published previously.⁵⁵ It measured 15 content categories in environmental controls (shade, outdoor work schedule), administrative procedures (risk assessment, training of employees and managers/supervisors, policy monitoring, resource allocation, communication with clients/patrons, compliance by contractors/subcontractors, and posting of UV Index) and personal protection practices (use of UV-protective clothing [i.e., long-sleeved shirt and long pants/skirt], hats, protective eyewear, and sunscreen, and regular skin cancer screening). Summed scores indicating the presence of any sun protection policy and of best-practice sun protection policy were analyzed.⁵⁵

Policy implementation measures.—Implementation of sun safety actions, the primary outcome of this follow-up study, was measured in three ways. Project staff inspected the workplaces for sun protection messages provided in the *SSW* or created by the employer and personal sun protection items (i.e., sunscreen; shade structures). Frontline supervisors reported whether the organization provided personal sun protection equipment for employees, i.e., sunscreen, wide-brimmed hats, sunglasses, long-sleeved shirts, long pants, or outdoor shade,⁵⁷ the organization or themselves communicated with employees about sun safety,^{47,50–52} and the organization had unwritten standard operating procedures on sun safety. Employees reported whether they had received any sun safety messages in written or electronic (email or website) formats from the local government organization, training on sun safety at the workplace, or messages on sun safety from a coworker. Employees also indicated if they were aware of any changes in the workplace to promote sun safety. Frontline supervisors and employees also reported their personal sun protection practices; analyses of these outcomes are reported elsewhere.⁵⁸

Intervention

Sun Safe Workplaces (SSW) intervention.—The *SSW* program advocated for adoption of occupational sun safety policies and provided training in personal sun protection for outdoor workers. *SSW* was guided by Diffusion of Innovations Theory (DIT)⁵⁹ and two relationship development models: Social Penetration Theory⁶⁰ and Stages of Relational Development.⁶¹ Based on DIT, *SSW* promoted sun safety policy and training by increasing the perceived need for workplace sun safety and fit with workplaces' safety mission/procedures. Accordingly, the *SSW* program bundled occupational sun safety with worksite safety goals and assisted managers in identifying ways to alter the policies/education and/or the workplace to improve fit. *SSW* also provided managers with communication strategies to clarify these changes to other managers and employees.⁶² Based on the relationship theories, project staff developed working relationships with managers and engaged in involved communication about policies and education on sun safety to reduce their uncertainty⁶³ about sun safety. Occupational sun safety advice from national authorities (e.g., CDC and NIOSH) was highlighted for credibility/trust, and public commitment from managers to adopt and implement policy and training was encouraged.⁶⁴

The intervention included meetings with managers and provision of online and printed materials. Staff met with the key contact manager at each organization and introduced *SSW*; advocated for sun safety policy adoption, reinforcement, and maintenance; presented the *SSW* website; and reviewed the Sun Safety Tool Box, worksite audit, policy-writing tool, and fact sheets on sun safety on the website. The contact manager scheduled the *SSW* Sun Safety Training by project staff with various employee groups, which was based on DIT and Social Cognitive Theory⁶⁵ and designed to fit into workplace safety. Workplace Sun Safety Materials were sent in four sets (twice a year over two years) to the contact manager (i.e., 10 posters, six tip cards, a sticker, a sunscreen discount coupon, and a CD on total skin self-examination). Project staff made monthly follow-up contacts with the contact manager to support decisions to write policies and train employees and problem solve barriers. See Buller et al.⁵⁷ for more information.

Attention-control intervention.—Local government organizations in the control group received printed information on occupational sun safety twice a year to create an attention-control condition, i.e., posters with personal sun protection and skin cancer incidence rates, risk assessment brochures, worksite guide, total skin self-examination CD, the American Academy of Dermatology SPOT bookmark, and a sun safety tip card from the Occupational Safety and Health Administration. Presentations on general sun safety topics, not policy, were made at state professional conferences.

Analysis of Two-Year Follow-up Assessment

Observed total number of *SSW* materials and of sun protection items in the workplace were analyzed at the organizational level using PROC GENMOD in SAS, fitting Poisson regression models. Analyses tested the differences between experimental conditions (*SSW* intervention v. control) and the relationship of the observed materials and items and the presence of occupational sun protection policy. Also, frontline supervisors' reports of sun protection actions and communication about sun safety and employees' reports of

communication about sun safety were modeled using multilevel analysis. In these analyses, differences between experimental conditions and association with the presence of occupational sun protection policy assessed in main trial were examined. PROC MIXED in SAS was employed for continuous outcomes and PROC GLIMMIX in SAS was used for binary outcomes with employer characteristics and employee demographics included as covariates using stepwise model selection at $p < 0.15$, two-tailed. Moderators of the impact of experimental conditions and presence of policy were also tested by examining two-way interactions with size of employer (based on number of employees) and employees' age and tenure in the workplace (in years) in the multilevel models. Alpha criterion levels were set at 0.05 (two-tailed) for all tests.

Results

Profile of the Samples

A total of 63 of the original 98 local government organizations in the trial (64%) agreed to participate in the two-year follow-up (Table 1). Half were municipal governments; 10% were county governments; and two-fifths were special districts. Most were located in the Denver metropolitan area or southern and western Colorado. Organizations averaged 226 employees overall. There were no statistically significant differences in employer characteristics between organizations in the original trial and those followed up.

Three hundred thirty frontline supervisors completed the follow-up survey (Table 1). Half had worked at the employer 15 years or more and more were employed in public safety. Over three-fifths reported working mostly outdoors or outdoors and indoors equally but less than 5% reported not working outside at all in the summer (<9% in the winter). The average number of hours worked per week outdoors was 15.53 (sd=14.05) in the summer and 11.68 (sd=12.20) in the winter. Frontline supervisors were predominately male and most were white, with 31% having the highest-risk skin types (Type I or II) and nearly 10% having been diagnosed with skin cancer. Frontline supervisors at intervention organizations tended to be longer-tenured in their jobs ($p < 0.001$), to be in public safety jobs ($p < 0.001$), and male ($p = 0.039$) than those at control organizations.

One thousand, four hundred fifty-four employees completed the survey. By comparison to supervisors, employees had less tenure in the workplace (78% working less than 15 years) and the largest number of employees were employed in public works. Also, four-fifths of employees worked mostly outdoors or outdoors and indoors equally (mean= 23.11 [sd=15.77] hours in the summer and 17.14 [sd=15.40] hours in the winter per week). Like supervisors, employees were mostly male and white, with 26% having Type I or II skin at highest risk for skin cancer and 8% having been diagnosed with skin cancer. Employees at intervention organizations were longer-tenured ($p = 0.003$), more often worked in public works jobs ($p < 0.001$), worked outside for about two hours less ($p = 0.003$), were older ($p < 0.001$), and married ($p = 0.005$) compared to those at control organizations.

Effect of Sun Safe Workplaces Intervention

Observed use of *SSW* sun protection messages and of sun protection items (e.g., sunscreen; shade structures) was higher at local government organizations in the intervention than the control group at the two-year follow-up (Table 2). Survey responses from frontline supervisors and employees regarding sun protection messages were consistent with these observations. Frontline supervisors in the intervention organizations reported more communication about sun protection to employees, more standard operating procedures on sun safety, and more free/reduced cost sunscreen than in the control organizations (Table 3). Compared to control organizations, employees at intervention organizations confirmed that they received more written and electronic sun safety messages from the employer and from coworkers, and more training on sun protection (Table 3). The proportion of frontline supervisors reporting that the organization communicated to employees about sun safety was significantly correlated with proportion of employees who reported receiving written communication ($r=0.41$, $p=0.003$) and training ($r=0.32$, $p=0.020$; electronic communication $r=0.07$, $p=0.607$; coworker communication $r=0.20$, $p=0.160$). However, the proportion of frontline supervisors reporting that they communicated about sun safety with employees was not related to employees' reports about communication (written communication $r=0.03$, $p=0.845$; electronic communication $r=-0.13$, $p=0.357$; coworker communication $r=-0.05$, $p=0.727$; and training, $r=-0.04$, $p=0.751$).

Moderation of Effect of Treatment Group

Organization size based on the number of employees moderated the effect of the treatment. Larger local government organizations in the intervention group took more sun safety actions than smaller organizations. Specifically, the total sun protection messages and items observed was highest in larger intervention organizations (control: 100 employees – $M=2.76$, 200 employees – $M=2.62$, 300 employees – $M=2.50$, 400 employees – $M=2.37$, 500 employees – $M=2.26$, 600 employees – $M=2.15$; intervention: 100 employees – $M=5.32$, 200 employees – $M=5.48$, 300 employees – $M=5.65$, 400 employees – $M=5.82$, 500 employees – $M=6.00$, 600 employees – $M=6.18$). Likewise, more frontline supervisors in larger intervention organizations reported that the employer had provided wide-brimmed hats, long pants, and temporary or permanent shade to protect employees from the sun than in smaller intervention organizations (Table 5). Reports on implementation of these actions in control workplaces which were lower than in intervention organizations did not differ by size of employer.

Age, length of tenure, and marital status moderated the effect of treatment on employees' reports on sun safety messages and workplace actions. In control organizations, fewer older employees reported receiving sun protection communications and training in sun safety or were aware of changes in the workplace to support sun protection than younger employees (Table 5). In intervention organizations, age did not affect reports of communication and awareness of such changes. By contrast, in intervention organizations, longer-tenured employees were more likely to report receiving electronic messages and training promoting sun safety than shorter-tenured employees. Reports on these actions in control organizations did not differ by tenure. Finally, married employees in intervention organizations reported more communication (written, electronic, or from coworkers) and changes in the workplace

to support sun safety while married employees in control organizations reported less communication and changes related to sun safety (Table 5).

Effect of Presence of a Sun Protection Policy

Local government organizations with a sun protection policy also implemented more communication about sun safety and provided more items to help employees protect themselves than organizations without these policies (Table 2). Frontline supervisors and employees also reported more communication on sun safety at organizations with a policy than without a policy (Table 4).

Moderators of the Effect of Sun Protection Policy

The effect of the presence of a sun protection policy on organizations' sun safety actions was also moderated by employer size and employees' age and tenure. At organizations with sun protection policies, more frontline supervisors at larger organizations reported the provision of temporary or permanent shade than at smaller organizations, with no change in reports at organizations without sun protection policies by employer size (Table 5). Compared to younger and shorter-tenured employees, older employees reported more electronic messages promoting sun safety at organizations with a sun protection policy while longer-tenured employees reported more training in sun safety at organizations with a sun protection policy (Table 5).

Discussion

Two years following the *SSW* intervention, local government organizations appeared to be taking several actions to communicate and support sun safety by employees. This was evident both in observed use of *SSW* messages and sun safety items in the workplace (e.g., sunscreen; shade structures) and in reports by frontline supervisors and employees two-years post-intervention. Immediately after the intervention, senior managers at intervention organizations had reported that the organizations provided more wide-brimmed hats for employees.⁵⁷ After two years, it appears that organizations were taking a wider range of actions, including a variety of communications promoting sun safety both from the organization and among coworkers and providing free/reduced-cost sunscreen. These findings are consistent with research on other health behaviors, such as tobacco use, physical activity, and diet,³⁴⁻⁴¹ that showed benefits from policy interventions. Multi-component interventions that combine environmental and individual components has changed diet and physical activity.⁶⁶

Policy adoption may be a way to create sustained implementation of occupational sun safety over time, which can be challenging⁶⁷⁻⁷⁰ but necessary to achieve real changes in employee sun protection practices. It has been argued that sustained implementation is an evolving process of mutual adaptation of the organization and innovation,⁶⁷ and this may have been the case in this study. For instance, evolution of policy implementation was identified in one study of a workplace smoke-free policy, where employee education increased staff support for the policy and new actions arose after one year (e.g., a smoke-free hiring policy).⁷¹ In the present study, local government organizations seemed to allocate more resources to purchase

sun protection items, generated staff support for the sun safety policy, and found further opportunities to promote sun protection to employees in the two years after receiving *SSW* than reported immediately following the intervention.⁵⁷ While cost can be a barrier, the results suggested that overtime, these organizations were able to identify funds to support providing sun protection items. It may be that the policy helped convince leaders setting the organizations' budgets that employee sun protection was a priority and needed resources. Stimulating implementation of preventive actions (i.e., sun protection actions for workers) by the employers over several years witnessed in both in the *SSW* intervention group and among organizations adopting a sun safety policy may explain how combining workplace education and policy has succeeded in producing positive outcomes in employee health and well-being.^{33,72–75} However, how long implementation will continue without active support from outside change agents is unknown, although it is hoped that written policy has permanence and persisting influence on organizations' actions. Policy is likely to be an external motivation for employees' to change sun safety practices; future research should compare the *SSW* intervention to interventions that create internal motivation for employee behavior such as providing incentives.⁷⁶

The influence of the intervention and policy may have been greater in larger rather than smaller organizations, as has been seen in past research on local government innovation.^{77–82} Larger organizations may have more existing processes to enable sun safety actions. For instance, larger organizations may provide work uniform allowances that could be used to purchase long pants or wide-brimmed hats. They may have many more formalized communication channels and training programs or staff with skills to communicate effectively to deliver sun safety messages.⁸³ Also, larger organizations may have more slack resources to devote to items to support employee sun safety than smaller organizations,^{78,84} especially costly equipment like temporary or permanent shade, although analyses of the sun safety policies at baseline in this study found no association with local government budgets.⁸³ Finally, larger organizations also may have been in more urbanized, cosmopolite communities^{85–87} where managers have more external connections and are more attuned to news and current affairs. Cosmopolitanism has predicted innovation by local governments,⁷⁷ including in our analysis of sun safety policies at baseline in this trial.^{83,88} However, the *SSW* intervention seemed to close the gap in adoption of sun safety policy between local government organizations farther or closer to the urban Front Range in Colorado at the immediate posttest.⁵⁷

The effectiveness of *SSW* may be increased by including ways of supporting sun protection that are easy to deploy and/or inexpensive to help smaller, resource-challenged organizations. It might distribute ready-made messages for employees, information to educate employees on selecting their own sun safe work clothing when uniforms are not provided, or training employees how to find shade provided by existing equipment such as sitting in the shade cast by a truck while taking a break or eating lunch. It must be noted that in most cases smaller organizations in the intervention group or with sun safety policy appeared to increase their sun safety actions beyond those in the control group or without policies. Smaller organizations may actually have had flexibility to innovate,⁸⁹ possibly from having less formalized structures and fewer external demands. This suggests that

employer size altered the extent of sun safety actions, but *SSW* convinced organizations of all sizes to take steps to support employee sun safety.

The patterns of moderation from employee reports about sun safety communication, training, and workplace changes suggested that *SSW* and sun protection policies had beneficial effects on older and longer-tenured employees who seemed to be more aware of efforts to promote and support occupational sun protection. These employees may be more integrated into the work culture and more attuned to health issues, given their life experiences. *SSW* appeared to close a pre-existing gap among older and longer-tenured employees in communication about sun safety at baseline. Before *SSW*, older/longer-tenured employees may have felt that they already knew from experience how to work safely or believed there is little they could do to reverse years of sun damage, but the increased communication and support for sun safety provoked by *SSW* captured the attention of these older/longer-tenured employees. One of the presumed benefits of policy is to eliminate differences that exist when employees are left to their own decision-making about disease prevention.

The original randomized trial and the two-year follow-up had some limitations. The generalizability of the results may be best in high-elevation states in the western United States and with local government organizations, but we have improved sun protection in a private outdoor recreation workforce. The two-year follow-up data are limited by the loss of 36% of the original sample of organizations; however, the lack of differences by follow-up status and treatment group implied that the follow-up sample well represented the original sample of organizations. The assessment of sun safety actions included observations at the workplace using established procedures, but the frontline supervisors and employees provided self-reports that are open to social desirability and demand biases, and a Hawthorne effect, although randomization should have equalized these biases across experimental conditions. Frontline supervisors' reports of their own communication with other employees may be most susceptible to these biases, as these reports did not correlate with employees' recall of communication. Their reports of communication by the organization were associated with employees' recall of written communication and training, providing evidence of concurrent validity. Temporal trends, such as increased media attention to sun safety, may have impacted the outcomes but again randomization should have balanced this bias. Frontline supervisors and employees were self-selected, working with senior workplace managers, rather than randomly selected from employee roles, so selection bias was possible (i.e., longer-tenured, older, married, and male workers). Finally, replicability is a concern even in randomized trials and in this case it was strengthened by grounding the *SSW* in well-established theories and designing samples to provide sufficient statistical power.⁹⁰ Also, we reported exact p-values to allow the application of lower p-values⁹¹ to increase replicability, i.e., $p=0.01$ or $p=0.005$ ⁹² (although this method is controversial⁹³). Several of the effects of *SSW* remain statistically significant at these lower p-values, instilling confidence that *SSW* truly increased implementation of sun safety actions by local government organizations.

Outdoor work continues to be a risk factor for skin cancer for a sizable number of adults. Formal policies on sun protection along with training appear to be an essential component of

occupational sun protection efforts. It is critical to note that the *SSW* intervention appeared to stimulate local government organizations' actions overtime to promote occupational sun safety.

Acknowledgments

This research was funded by the National Cancer Institute (CA187191), which had no role in the design of the study and collection, analysis, and interpretation of data. The authors thank the managers and employees at the local government organizations that participated in the study for their support of the research.

Trial Registration: [Clinicaltrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT021824289) identifier—NCT021824289

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So What? Implications for Health Promotion Practitioners and Researchers**What is already known on this topic?**

Outdoor workers are exposed routinely to high doses of ultraviolet radiation and are at risk for skin cancer. Workplace interventions typically have promoted sun protection behavior by employees, with only a few promoting occupational policies. The authors' *Sun Safe Workplaces* intervention convinced managers at local government organizations to adopt sun safety policies addressing workplace environments and administrative procedures and promoting personal protection for workers.

What does the article add?

This article reports the results of a two-year follow-up assessment of implementation of sun protection policies adopted by local government organizations as a result of the *Sun Safe Workplaces* intervention. At the two-year follow-up, more sun safety messages and items were observed, frontline supervisors reported more free/reduced cost sunscreen and communication about sun safety to employees, and employees said they received more messages and training on sun protection at intervention compared to control organizations. Larger organizations were more likely to provide communication on sun protection and personal protection items such as wide-brimmed hats, long pants, and shade. Similar although smaller differences were seen when comparing organizations with and without occupational sun protection policies.

What are the implication for health promotion practice or research?

Occupational policies on sun protection will only be effective if they result in employers taking steps to promote and support sun protection by employees. The occupational sun protection policies promoted by the *Sun Safe Workplaces* intervention succeeded in increasing communication about sun safety and provision of personal sun protection items. Occupational sun protection policies appear to be an essential tool for meeting national goals in the U.S. Surgeon General's Call to Action to Prevent Skin Cancer.

Figure 1:
 CONSORT diagram for randomized trial and two-year follow-up assessment testing the effect of the SSW intervention compared to an attention control condition.

Table 1:

Profile of local government organizations, frontline supervisor, and employee samples

Local Government Organizations (n=63)		
Characteristics		
Type of organization		
	City	50.8%
	County	9.5%
	Special taxing district	39.7%
Size of organization (number of employees; mean (std dev))		225.94 (419.77)
Percentage of female senior managers (mean [SD])		22.0% (20.6%)
Household income (in dollars) of weighted county population (mean [SD])		78,034.50 (18,882.29)
Percentage residents with bachelor degrees or higher of weighted county population (mean [SD])		37.3% (12.7%)
Distance (in miles) from urban Front Range of Colorado (mean [SD])		87.16 (97.79)
Frontline Supervisors (n=330)		
Characteristics		%
Length of time working for employer		
	0–4 years	21.5
	5–14 years	29.3
	15–20 years	24.0
	21 years or more	25.2
Type of position		
	Public works	29.0
	Public safety	32.8
	Parks and recreation	23.4
	Other	14.8
Work outdoors or indoors		
	Mostly outdoors	21.6
	Outdoors and indoors about equally	40.7
	Mostly indoors	37.7
Hours work outdoors in a typical week		
	In Summer: 0 hours	4.4
	1–5 hours	28.4
	6–10 hours	22.7
	11–20 hours	16.7
	21 hours or more	27.8
	In Winter: 0 hours	8.5

Local Government Organizations (n=63)		
Characteristics		
	1–5 hours	38.3
	6–10 hours	18.7
	11–20 hours	17.1
	21 hours or more	17.4
Age		
	18–34	12.8
	35–44	29.2
	45–54	33.8
	55 or older	24.2
Hispanicity		
	Not Hispanic	92.4
	Hispanic	7.6
Race		
	American Indian/Alaska Native	1.4
	Asian	0.3
	Native Hawaiian/Other Pacific Islander	0.0
	Black/African American	1.4
	White	95.5
	More than one race	1.4
Skin type		
	Always burns and is unable to tan	7.2
	Usually burns but can tan if I work at it	24.0
	Sometimes mildly burn and then tans easily	42.9
	Rarely burns and tans easily	25.9
History of skin cancer		
	No	90.1
	Yes	9.9
Education		
	Less than high school graduate	1.3
	High school graduate	14.5
	Trade, technical, or vocational education beyond high school	6.2
	Some college	22.4
	4-year college graduate or postgraduate degree	55.6
Marital status		
	Never married	7.6
	Widow/separated/divorced	12.9
	Married or living with a partner	79.5

Local Government Organizations (n=63)		
Characteristics		
Children under 18 living in the home		
	No	56.0
	Yes	44.0
Gender		
	Female	16.0
	Male	84.0
Employees (n=1,454)		
Characteristics		%
Length of time working for employer		
	0–4 years	46.4
	5–14 years	31.9
	15–20 years	11.3
	21 years or more	10.4
Type of position		
	Public works	36.4
	Public safety	17.0
	Parks and recreation	23.4
	Other	23.2
Work outdoors or indoors		
	Mostly outdoors	54.5
	Outdoors and indoors about equally	24.8
	Mostly indoors	20.7
Hours work outdoors in a typical week		
	In Summer: 0 hours	6.1
	1–5 hours	12.6
	6–10 hours	16.7
	11–20 hours	13.3
	21–30 hours	14.7
	31 hours or more	36.6
	In Winter: 0 hours	15.6
	1–5 hours	18.3
	6–10 hours	16.1
	11–20 hours	15.7
	21–30 hours	13.7
	31 hours or more	20.6
Age		

Local Government Organizations (n=63)		
Characteristics		
	18–24	13.4
	25–34	20.6
	35–44	24.4
	45–54	20.4
	55 or older	21.2
Hispanicity		
	Not Hispanic	89.0
	Hispanic	11.0
Race		
	American Indian/Alaska Native	1.8
	Asian	0.6
	Native Hawaiian/Other Pacific Islander	0.4
	Black/African American	1.1
	White	93.5
	More than one race	2.6
Skin T]type		
	Always burns and is unable to tan	4.5
	Usually burns but can tan if I work at it	21.6
	Sometimes mildly burn and then tans easily	44.8
	Rarely burns and tans easily	29.1
History of skin cancer		
	No	92.0
	Yes	8.0
Education		
	Less than high school graduate	1.4
	High school graduate	20.4
	Trade, technical, or vocational education beyond high school	10.6
	Some college	30.9
	4-year college graduate or postgraduate degree	36.7
Marital status		
	Never married	23.1
	Widow/separated/divorced	10.6
	Married or living with a partner	66.3
Children under 18 living in the home		
	No	61.4
	Yes	38.6

Local Government Organizations (n=63)		
Characteristics		
Gender		
	Female	20.4
	Male	79.6

Table 2:

Comparison of observed *SSW* messages and sun protection items in the workplaces by experimental condition and occupational sun protection policy

Experimental Condition			
Messages and Items	Control	Intervention	p
<i>Sun Safe Workplaces</i> messages (range=0 to 14)	0.93	3.09	<0.001
Other sun protection messages (range=0 to 3)	0.17	0.15	0.880
Sun protection items (range=0 to 9)	1.50	2.27	0.025
All sun protection messages and items (range=0 to 20)	2.60	5.52	<0.001
Occupational Sun Protection Policy (general score)			
Messages and Items	Coefficient		p
<i>Sun Safe Workplaces</i> messages (range=0 to 14)	1.16		<0.001
Other sun protection messages (range=0 to 3)	1.10		0.339
Sun protection items (range=0 to 9)	1.11		<0.001
All sun protection messages and items (range=0 to 20)	1.13		<0.001
Occupational Sun Protection Policy (best-practice score)			
Messages and Items	Coefficient		p
<i>Sun Safe Workplaces</i> messages (range=0 to 14)	1.19		<0.001
Other sun protection messages (range=0 to 3)	1.07		0.558
Sun protection items (range=0 to 9)	1.14		<0.001
All sun protection messages and items (range=0 to 20)	1.16		<0.001

Table 3:

Differences in frontline supervisors' and employees' reports on local government organizations' sun safety actions and communication by experimental condition

Frontline Supervisors (n=330)			
Experimental Condition			
Sun Safety Action	Control	Intervention	p
Free/reduced price sunscreen with SPF 15+	64.2%	89.4%	0.005
Wide-brimmed hats	25.3%	29.3%	0.644
Sunglasses	21.0%	28.2%	0.385
Long-sleeved work or uniform shirts	67.4%	78.8%	0.217
Long work or uniform pants	54.5%	64.3%	0.446
Temporary or permanent shade structures	36.2%	43.8%	0.441
Composite number of sun safety actions, mean (std dev)	2.34 (0.22)	2.76 (0.30)	0.161
Organization communicated sun safety messages to employees	67.5%	93.8%	<0.001
I communicated sun safety messages to employees	73.8%	82.4%	0.166
Unwritten standard operating, administrative, or training procedure to improve employee sun safety	36.7%	63.5%	<0.001
Employees (n=1,454)			
Experimental Condition			
Sun Safety Action	Control	Intervention	p
Seen/received written sun safety messages	49.8%	70.3%	<0.001
Seen/received electronic sun safety messages by email or on website	26.3%	36.4%	0.037
Received a sun safety message from coworkers	56.0%	69.9%	0.010
Received any training on sun safety	45.3%	70.0%	<0.001
Aware of any changes in sun safety practices or procedures at your workplace	23.3%	28.1%	0.242

Table 4:

Differences in frontline supervisors' and employees' reports on local government organizations' sun safety actions and communication by occupational sun protection policy

Frontline Supervisors (n=330)		
Occupational Sun Protection Policy (general score)		
Sun Safety Action	Odds Ratio ^I (95% CI)	P
Free/reduced price sunscreen with SPF 15+	1.23 (1.02, 1.49)	0.029
Wide-brimmed hats	1.03 (0.90, 1.18)	0.652
Sunglasses	1.00 (0.86, 1.15)	0.974
Long-sleeved work or uniform shirts	1.02(0.88, 1.19)	0.788
Long work or uniform pants	1.03(0.86, 1.22)	0.771
Temporary or permanent shade structures	0.97(0.85, 1.11)	0.688
Composite sun safety actions	0.50 ²	0.444
Organization communicated sun safety messages to employees	1.21 (1.003, 1.47)	0.047
I communicated sun safety messages to employees	1.18 (1.04, 1.34)	0.009
Unwritten standard operating, administrative, or training procedure to improve employee sun safety	1.02 (0.92, 1.13)	0.694
Occupational Sun Protection Policy (best-practice score)		
Sun Safety Action	Odds Ratio ^I (95% CI)	P
Free/reduced price sunscreen with SPF 15+	1.33 (1.06, 1.68)	0.015
Wide-brimmed hats	1.02 (0.87, 1.20)	0.786
Sunglasses	1.02 (0.86, 1.20)	0.840
Long-sleeved work or uniform shirts	1.01 (0.85, 1.21)	0.897
Long work or uniform pants	1.04 (0.85, 1.28)	0.699
Temporary or permanent shade structures	0.98 (0.84, 1.14)	0.757
Composite sun safety actions	0.50 ²	0.381
Organization communicated sun safety messages to employees	1.26 (0.99, 1.60)	0.051
I communicated sun safety messages to employees	1.19 (1.02, 1.38)	0.027
Unwritten standard operating, administrative, or training procedure to improve employee sun safety	1.02 (0.91, 1.14)	0.775
Employees (n=1,454)		
Presence of a Policy (general score)		
Sun Safety Action	Odds Ratio ^I (95% CI)	P
Seen/received written sun safety messages	1.09 (1.001, 1.18)	0.047
Seen/received electronic sun safety messages by email or on website	1.08 (1.01, 1.16)	0.033
Received a sun safety message from a coworkers	1.09 (1.01, 1.18)	0.024
Received any training on sun safety	1.08 (0.98, 1.19)	0.138
Aware of any changes in sun safety practices or procedures at your workplace	1.01 (0.95, 1.08)	0.717
Presence of a Policy (best-practice score)		
Sun Safety Action	Odds Ratio ^I (95% CI)	P

Frontline Supervisors (n=330)		
Occupational Sun Protection Policy (general score)		
Sun Safety Action	Odds Ratio ¹ (95% CI)	P
Seen/received written sun safety messages	1.09 (0.98, 1.20)	0.099
Seen/received electronic sun safety messages by email or on website	1.09 (1.00, 1.18)	0.057
Received a sun safety message from a coworkers	1.10 (1.01, 1.21)	0.033
Received any training on sun safety	1.09 (0.97, 1.23)	0.146
Aware of any changes in sun safety practices or procedures at your workplace	1.02 (0.95, 1.11)	0.552

¹ Odds of providing sun safety actions/communication versus not providing

² Coefficient

Table 5:

Moderation of differences in frontline supervisors' and employees' reports on local government organizations' sun safety actions and communication by employer size and employee age and length of tenure at the workplace

Frontline Supervisors (n=330)						
	Sunscreen	Wide-brimmed Hats	Sunglasses	Long-sleeved shirts	Long pants	Shade
Number of Employees						
Control						
100		51.2%			36.4%	10.6%
200		52.2%			35.6%	10.4%
300		53.1%			34.9%	10.2%
400		54.1%			34.1%	10.0%
500		55.0%			33.3%	9.8%
600		56.0%			32.5%	9.6%
Intervention						
100		50.7%			38.5%	11.3%
200		63.0%			52.7%	15.0%
300		73.8%			66.5%	19.7%
400		82.4%			78.0%	25.3%
500		88.6%			86.4%	32.0%
600		92.8%			91.9%	39.5%
		p=0.009			p=0.017	p=0.036
Number of Employees						
No Policy						
100						13.1%
200						12.7%
300						12.3%
400						12.0%
500						11.6%
600						11.3%
Policy						
100						5.8%
200						8.0%
300						11.0%
400						14.8%
500						19.7%
600						25.6%
						p=0.024
Employees (n=1,454)						

Frontline Supervisors (n=330)						
	Sunscreen	Wide-brimmed Hats	Sunglasses	Long-sleeved shirts	Long pants	Shade
	Written Message	Electronic Message	Message from Coworker	Training	Aware of Changes in Sun Safety Practices	
Age of Employee						
Control						
20	53.8%	26.4%		27.5%	18.4%	
30	50.5%	21.1%		23.3%	15.0%	
40	47.2%	16.7%		19.6%	12.2%	
50	43.9%	13.0%		16.4%	9.8%	
60	40.7%	10.0%		13.6%	7.9%	
70	37.5%	7.7%		11.2%	6.3%	
Intervention						
20	63.6%	20.4%		39.1%	14.0%	
30	66.3%	21.8%		39.6%	14.4%	
40	68.9%	23.3%		40.1%	14.8%	
50	71.4%	24.9%		40.6%	15.3%	
60	73.7%	26.5%		41.1%	15.8%	
70	75.9%	28.2%		41.6%	16.2%	
	p=0.015	p<0.001		p=0.035	p=0.012	
Age of Employee						
No Policy						
20		24.7%				
30		20.6%				
40		17.0%				
50		13.9%				
60		11.3%				
70		9.2%				
Policy						
20		24.6%				
30		24.7%				
40		24.9%				
50		25.0%				
60		25.2%				
70		25.3%				
		p=0.017				
Length of Tenure of Employee						
Control						
<1		20.2%		24.1%		

Frontline Supervisors (n=330)						
	Sunscreen	Wide-brimmed Hats	Sunglasses	Long-sleeved shirts	Long pants	Shade
5		19.5%		24.1%		
10		18.8%		24.0%		
15		18.2%		23.9%		
20		17.5%		23.8%		
25		16.9%		23.7%		
Intervention						
<1		24.4%		39.4%		
5		26.3%		44.3%		
10		28.3%		50.5%		
15		30.4%		56.7%		
20		32.5%		62.6%		
25		34.8%		68.3%		
		p=0.040		p=0.003		
Length of Tenure of Employees						
No Policy						
<1				32.2%		
5				33.1%		
10				34.1%		
15				35.0%		
20				35.9%		
25				36.9%		
Policy						
<1				34.0%		
5				39.3%		
10				45.0%		
15				50.7%		
20				56.5%		
25				62.1%		
				p=0.024		
Marital Status						
Control						
Other	54.2%	33.0%	65.4%		29.4%	
Married	48.4%	22.5%	52.0%		19.8%	
Intervention						
Other	62.2%	28.1%	64.2%		22.6%	
Married	75.4%	40.7%	72.6%		30.6%	
	p=0.002	p<0.001	p=0.001		p=0.003	