

Field Study

What Encourages Sun Protection among Outdoor Workers from Four Industries?

Monika JANDA¹, Melissa STONEHAM², Philippa YOUL³, Phil CRANE¹,
Marguerite C SENDALL¹, Thomas TENKATE⁴ and Michael KIMLIN¹

¹School of Public Health and Social Work, Institute of Health and Biomedical Innovation, Queensland University of Technology, Australia, ²Public Health Advocacy Institute of Western Australia, Faculty of Health Sciences, Curtin University, Australia, ³Cancer Council Queensland, Australia and ⁴School of Occupational and Public Health, Ryerson University, Canada

Abstract: What Encourages Sun Protection among Outdoor Workers from Four Industries?: Monika JANDA, *et al.* School of Public Health and Social Work, Institute of Health and Biomedical Innovation, Queensland University of Technology, Australia—**Objectives:** We aimed to identify current practice of sun protection and factors associated with effective use in four outdoor worker industries in Queensland, Australia. **Methods:** Workplaces in four industries with a high proportion of outdoor workers (building/construction, rural/farming, local government, and public sector industries) were identified using an online telephone directory, screened for eligibility, and invited to participant via mail (n=15, recruitment rate 37%). A convenience sample of workers were recruited within each workplace (n=162). Workplaces' sun protective policies and procedures were identified using interviews and policy analysis with workplace representatives, and discussion groups and computer-assisted telephone interviews with workers. Personal characteristics and sun protection knowledge, attitudes and behaviors were collated and analysed. **Results:** Just over half the workplaces had an existing policy which referred to sun protection (58%), and most provided at least some personal protective equipment (PPE), but few scheduled work outside peak sun hours (43%) or provided skin checks (21%). Several worker and workplace characteristics were associated with greater sun protection behaviour among workers, including having received education on the use of PPE ($p<0.001$), being concerned about being in the sun ($p=0.002$); and working in a

smaller workplace ($p=0.035$). **Conclusions:** Uptake of sun protection by outdoor workers is affected by a complex interplay of both workplace and personal factors, and there is a need for effective strategies targeting both the workplace environment and workers' knowledge, attitudes and behaviors to decrease harmful sun exposure further.
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Excessive exposure to ultraviolet radiation (UVR) of the sun causes negative health consequences such as premature ageing, eye diseases^{1,2}, and increases risk of non-melanoma (NMSC)^{3,4}, and possibly melanoma skin cancers^{5–7}. Australia has the highest rates of skin cancer in the world, two out of three residents will be diagnosed with a skin cancer before the age of 70⁸. This carries a high financial burden; for example in 2010, over 700 thousand NMSCs were treated in Australia costing the health system \$511 million⁹.

Outdoor workers are a group at risk for excessive UVR exposure and the corresponding negative consequences. Outdoor workers are defined here as those who work outdoors at least three hours of the day (between the hours of 9 am–3 pm) most days of the week and typically receive UVR exposure well above recommended limits^{10–12}, often without necessarily using adequate sun protection^{11,13–16}. Occupational sun exposure has been shown to have a strong relationship with the development of NMSCs^{3,4}, and may be linked to melanoma⁵. The association between outdoor work and skin cancers may be mediated by high levels of sun exposure, combined with inadequate use and poor uptake of sun protective measures inside and outside work hours⁶.

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Correspondence to: A/Prof. M. Janda, Queensland University of Technology, School of Public Health and Social Work, Institute of Health and Biomedical Innovation, Victoria Park Road, Kelvin Grove, Queensland, 4059 Australia (e-mail: m.janda@qut.edu.au)

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There is an identified need for interventions to promote sun safe behaviour and reduce UVR exposure among outdoor workers. Previous research has investigated the impact of workplace sun protection policies^{17, 18}, environmental and/or structural changes (e.g. provision of shade or personal protective equipment (PPE))^{19, 20}, education/awareness^{21, 22}, changing workplace culture^{23–25}, or appearance-based interventions on workers sun protection behaviors¹⁶. While some studies showed positive results, more evidence is needed to determine the most effective strategies which can be implemented across outdoor industries. Glanz *et al.* suggested that greatest impact will be gained from multi-component interventions targeting both employers and workers²⁶.

Occupational interventions are increasingly planned using a participatory action research (PAR) framework in health promotion²⁷, as it is suited for behavior change within complex systems. PAR uses an iterative process of observing, reflecting, planning, implementing and acting to achieve improved health outcomes, and highlights the active role needed by those people affected by the health intervention in all phases of the intervention design and implementation²⁸.

Previous research focussed on workers from one outdoor industry, while this study enrolled workers across four outdoor industries. This project followed pre-post design of an 18 month workplace intervention to assist workplaces to become more sun safe using a PAR framework. The results in this paper represent the baseline findings. We describe policies and procedures of each workplace, workers' sun protection knowledge, attitudes and behaviors, factors associated with using sun protection at the workplace, sunburn in the past 12 months, and perceived support for sun protection in their workplace.

Methods

The Queensland University of Technology ethics committee approved this project (number 100000968). The project used qualitative and quantitative research methods which occurred sequentially. Initially two qualitative methods, PAR and policy analysis, were used to obtain knowledge, attitudes, intentions and behaviors among workplaces and workers, and to understand the context of outdoor work and sun protection in each workplace. Quantitative survey data was then collected to triangulate workers', attitudes, beliefs and behaviors, and assess factors associated with these outcomes.

Participants and recruitment

Workplaces were selected from four industries: building/construction, rural/farming, local government,

or public sector. Small (≤ 30 employees) or large (≥ 100 employees) workplaces within 150 kilometres of an airport to allow site visits were potentially eligible, and screening calls were made to about every 33rd workplace on a list derived from yellow pages industry listings and online search entries. Eligible workplaces received an invitation letter, and follow-up phone to establish consent and identify a workplace champion to be the designated point of contact during the project (e.g. Workplace Health and Safety Officer). Workplace champions were interviewed by telephone and in person during a site visit about workplace structures, sun protection policies and the sun protection procedures in place. Semi-structured discussion groups with workers on-site obtained their views on the current status of sun protection at their workplace and how it could be improved.

Worker survey

Computer Assisted Telephone Interviews (CATIs) with workers collected socio-demographic characteristics, skin cancer risk factors, skin cancer history, sun protection attitudes, beliefs and behaviors at work, knowledge of their organisation's sun protection policy and perception of support for sun protection, and provision and use of shade and PPE while at work. Survey items were adapted from our previous research²⁹, or other work investigating outdoor workers sun protection behaviour³⁰, while others were created for this study. Details of question wording and response categories can be found in the Tables.

Three primary outcome measures were computed: 1) sun protection score; 2) sunburn score; and 3) perceived workplace support score.

Sun protection score

Workers' usual level of sun protection while at work was computed into sun protection behavior index³⁰, which measured six behaviors (using natural/artificial shade, limiting time in sun between 10 am and 3 pm, wearing a hat, collared shirt with sleeves, sunglasses, or sunscreen). Frequency of use for each sun protection behavior was rated using a 5-point ordinal scale ranging from 1=rarely to 5=always. Scores were averaged to compute an overall "sun protection score" (range 1–5)²⁶.

Sunburn Score

Two questions on the frequency and severity of sunburn while at work in the past 12 months were used to compute an overall sunburn score (ranging from 1=sunburnt once or less, not severely); 2=sunburnt 2–5 times, not severely; 3=sunburnt 6 or more times, or sunburnt severely once; 4=sunburnt severely 2–5 times; 5=sunburnt severely 6 or more

times).

Perceived workplace support score

Workers' overall perceptions of workplace support for sun protection was computed using 4 attitude statements: "sun protection is valued at my workplace", "sun protection is enforced at my workplace", "my supervisors protect themselves from the sun", and "my colleagues protect themselves from the sun", each measured on a 5-point Likert scale (1=strongly agree to 5=strongly disagree). Items were reverse coded, so that a higher score indicates a higher level of perceived workplace support. Scores were averaged to compute an overall "workplace support score" (range 1–5).

Statistical analysis

SPSS statistical package (version 19.0.0.2) was used. Demographic, skin cancer risk factors, knowledge, attitude and workplace variables were assessed for their association with the three outcome measures (sun protection behavior, sunburn, and perceived workplace support) using bivariable general linear models (data not shown). Variables found to be associated at a conservative p -value of <0.1 were entered for each score into multivariable general linear models to investigate their independent contribution and to derive a parsimonious model for each outcome. One-way anovas were conducted for each of the three outcome measures to assess the relationship with workplace type.

Results

Overall, of 125 workplaces screened, 38 were potentially eligible (Fig. 1), and 15 (39%) agreed to participate (roughly equal numbers from local government, construction, public sector and farming industries; and small/ large workplaces). One workplace participated only in the worker survey component of the project reported here. Based on workplace champions' reports, 53% of workplaces had some form of sun protection policy in place often embedded in the general health and safety policy documents, 64% advised the use of natural shade, 57% provided artificial shade, and a smaller number of workplaces scheduled work outside of peak UV hours (43%). Out of the five types of PPE (hat, long-sleeved collared shirt, long trousers, sunglasses and sunscreen), workplaces provided a median of 4.5 (range 0–5), however not all hats were wide-brimmed. Fifty per cent of workplaces provided education on use of PPE, and 21% skin checks for employees. Supervisors were required to model sun safe behavior in 64% of workplaces (Table 1).

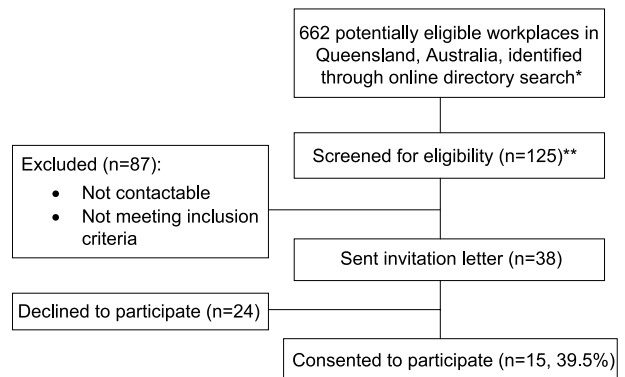


Fig. 1. Recruitment of Workplaces

* Search terms used and number of potentially eligible workplace identified differed depending on region to ensure roughly equal number of workers from different outdoor work industries – Far North (n=143); North West (n=7); Darling Downs (n=185); Mackay (n=327); Brisbane (n=1). ** Screening calls were made to every 33rd workplace on the list of potentially eligible workplaces for that region. If workplace was unreachable after three phone calls at different times over 3 consecutive days, it was excluded and an attempt was made to contact the next workplace on that list.

Worker characteristics

Sociodemographic characteristics of the 162 outdoor workers (median age=43 years, range 18–68) are reported in Table 2. Most were men (151, 93%), married/in a de-facto relationship (95, 59%), and born in Australia (145, 90%). Median age was 43 years old (range 18–68). Only 8% had completed university or college and less than half (41%) had private health insurance. There were similar numbers of workers between each industry; local government 39 (24%), building/ construction 36 (22%), public sector 38 (24%) and rural/farming 49 (30%) workers.

Workers' skin cancer risk factors and perception of risk are also described in Table 2. A third of workers had fair hair (31%), but few (7%) reported they never tan, only burn. However, 68 (42%) workers already had a skin cancer, mole or other spot removed or treated, and 70% believed it was likely they would develop skin cancer in the future. Most workers (81%) were aware of some sun protection policy or procedure at their workplace, but few (6%) reported their workplace offered any incentives for sun safety. More than half of the workers had received some training on use of PPE for sun protection (65%). Most workers (81%) agreed sun protection was valued at their workplace, while just over half (56%) agreed it was enforced (Table 2).

Provision and self-reported frequency of use of PPE is reported in Table 3. Workers reported that the most frequently provided items were sunscreen (93%), long-sleeved collared shirts (85%), and sunglasses

Table 1. Summary of workplace information

| Characteristic | n | (%) |
|---|-----|--------|
| Area of Queensland ^a | | |
| Darling Downs | 3 | (20.0) |
| Mackay | 4 | (26.7) |
| North West | 3 | (20.0) |
| Far North | 4 | (26.7) |
| Southeast | 1 | (6.7) |
| Industry | | |
| Local government | 3 | (20.0) |
| Building construction | 4 | (26.7) |
| Public sector | 4 | (26.7) |
| Farm | 4 | (26.7) |
| Size | | |
| Small (approx 30 employees or less) | 7 | (46.7) |
| Large (approx 100 employees or more) | 8 | (57.1) |
| Existing sun protection strategies ^b | | |
| Policy: Has a policy related to sun protection | 8 | (57.0) |
| Structural/environmental: | | |
| Advises use of natural shade | 9 | (64.3) |
| Provides artificial shade | 8 | (57.1) |
| Schedules work outside hours of 10 am–3 pm | 6 | (42.9) |
| PPE: Number of PPE provided ^c (median, range) | 4.5 | (0–5) |
| Education: Provides education about use of PPE to reduce sun exposure | 7 | (50.0) |
| Skin examination: Provides skin checks for employees | 3 | (21.4) |
| Workplace culture: Supervisors required to model sun safe behaviour | 9 | (64.3) |

^aBased on statistical regions of Queensland sampled for this project. ^bMissing data for 1 workplace. ^cIncludes hat, long-sleeved collared shirt, long trousers, sunglasses and sunscreen.

(75%), hard hats (72%), and enclosed boots/shoes (72%). Fewer workers reported the provision of other types of PPE including broad-brimmed hats (69%), hard hats with brims (57%) or brim and flaps (53%), or other hats (30%). The majority of workers reported using PPE usually or always, with sunscreen least frequently used (40%).

Multivariable analyses

1) Sun protection score

Workers' mean sun protection score at work was 3.41 out of 5 (standard deviation 0.69). Workers who reported skin which usually burns ($p=0.023$), and who had received formal training on the use of PPE ($p<0.001$) were significantly more likely to report a higher sun protection score. Two attitude variables also were significantly associated with a higher sun protection score: being in the sun during work ...“is one of my biggest concerns” ($p=0.002$), and ...“is just part of my normal working life” ($p=0.036$). Sun protection scores were higher for workers at smaller

workplaces ($p=0.035$) and workplaces which provided formal training for use of PPE ($p=0.029$) (Table 4). The sun protection score differed significantly by industry type ($F=3.3$; $p=0.02$) with the lowest sun protection score recorded by workers in farming (mean=3.20), compared to highest among workers in construction and building industry (mean=3.60).

2) Sunburn score (sunburn in the last 12 months)

Workers' mean sunburn score was 1.98 out of 5 (standard deviation 1.04). Workers who reported typically being outside more than six hours per day ($p=0.010$), and currently concerned about a spot or mole ($p=0.013$) had significantly higher, while workers who agreed that sun protection was enforced at their workplace had somewhat lower sunburn scores ($p=0.055$) (Table 5a).

3) Perceived workplace support for sun protection

Workers' mean workplace support score was 3.67 out of 5 (standard deviation 0.62). In multivariable

Table 2. Worker characteristics^a

| Characteristic | n=162 | (%) |
|--|-------|--------|
| Sociodemographic characteristics | | |
| Gender | | |
| Male | 151 | (93.2) |
| Female | 11 | (6.8) |
| Marital status | | |
| Married/living together | 95 | (58.6) |
| Divorced/separated | 12 | (7.4) |
| Single | 54 | (33.3) |
| Highest level of education completed | | |
| Primary school/junior high (year 7 or 8) | 6 | (3.7) |
| Some high school (year 9–12) | 72 | (44.4) |
| Trade/technical certificate or diploma | 71 | (43.8) |
| University or college degree | 13 | (8.0) |
| Country of birth | | |
| Australia | 145 | (89.5) |
| Other ^b | 14 | (8.6) |
| Private insurance | | |
| Yes | 67 | (41.4) |
| No/ don't know | 95 | (58.6) |
| Household income | | |
| Less than \$40,000 | 25 | (19.2) |
| \$40,000 to \$79,999 | 59 | (45.4) |
| \$80,000 or more | 46 | (35.4) |
| Don't know | 14 | (8.6) |
| Refused | 18 | (11.1) |
| Skin cancer risk factors | | |
| Eye colour | | |
| Brown or black | 49 | (30.2) |
| Blue or grey | 53 | (32.7) |
| Green or hazel | 60 | (37.0) |
| Natural hair colour | | |
| Dark brown or black | 55 | (34.0) |
| Light brown | 56 | (34.6) |
| Sandy/Blonde | 39 | (24.0) |
| Red | 11 | (6.8) |
| Skin colour before tanning | | |
| Fair | 98 | (60.5) |
| Medium | 33 | (20.4) |
| Olive/brown/black | 31 | (19.6) |
| Skin after exposure to strong sun for 30 minutes without protection | | |
| Burn without tanning afterwards | 29 | (17.9) |
| Burn then tan | 73 | (45.1) |
| Tan without burning | 56 | (34.6) |
| Deepness of tan following exposure to sun exposure over several days | | |
| Never tan, only burn/freckle | 12 | (7.4) |
| Slightly tan | 42 | (25.9) |
| Moderately tan | 73 | (45.1) |
| Deep tan | 27 | (16.7) |

Table 2. Worker characteristics^a (continued)

| Characteristic | n=162 | (%) |
|---|-------|--------|
| Don't know/unsure | 8 | (4.9) |
| Has previously had skin cancer, mole or other spot removed | | |
| Yes | 68 | (42.0) |
| No | 94 | (58.0) |
| How likely is it that you will get skin cancer at some time in the future? | | |
| Not at all likely | 19 | (11.7) |
| Somewhat likely | 67 | (41.4) |
| Very likely | 49 | (30.2) |
| Don't know/unsure | 27 | (16.7) |
| Currently concerned about a spot/mole | | |
| Yes | 37 | (22.8) |
| No/don't know | 125 | (77.2) |
| Has ever checked skin for early signs of skin cancer | | |
| Yes | 74 | (45.7) |
| No | 88 | (54.3) |
| Doctor has checked skin for early signs of skin cancer in past 12 months | | |
| Yes | 51 | (31.5) |
| No/don't know | 111 | (68.5) |
| Attitudes, norms and beliefs | | |
| Sun protection is valued at my workplace | | |
| Strongly disagree/ disagree | 9 | (5.6) |
| Neither agree nor disagree | 9 | (5.6) |
| Agree/ strongly agree | 131 | (80.9) |
| Sun protection is enforced at my workplace | | |
| Strongly disagree/ disagree | 45 | (27.8) |
| Neither agree nor disagree | 14 | (8.6) |
| Agree/ strongly agree | 90 | (55.6) |
| My supervisors or managers protect themselves from the sun well | | |
| Strongly disagree/ disagree | 21 | (13.0) |
| Neither agree nor disagree | 25 | (15.4) |
| Agree/ strongly agree | 103 | (63.6) |
| My colleagues protect themselves from the sun well | | |
| Strongly disagree/ disagree | 22 | (13.6) |
| Neither agree nor disagree | 16 | (9.9) |
| Agree/ strongly agree | 111 | (68.5) |
| Being in the sun during work is one of my biggest concerns | | |
| Strongly disagree/ disagree | 68 | (42.0) |
| Neither agree nor disagree | 13 | (8.0) |
| Agree/ strongly agree | 68 | (42.0) |
| Being in the sun during work is just part of my normal working life | | |
| Strongly disagree/ disagree | 4 | (2.5) |
| Neither agree nor disagree | 2 | (1.3) |
| Agree/ strongly agree | 143 | (88.3) |
| I have other health concerns that are more important than those caused by too much sun exposure | | |
| Strongly disagree/ disagree | 76 | (46.9) |
| Neither agree nor disagree | 24 | (14.8) |
| Agree/ strongly agree | 49 | (30.2) |

Table 2. Worker characteristics^a (continued)

| Characteristic | n=162 | (%) |
|---|-------|--------|
| My employer has a responsibility under Workplace Health and Safety procedures to protect me from the sun | | |
| Strongly disagree/ disagree | 20 | (13.3) |
| Neither agree nor disagree | 12 | (7.4) |
| Agree/ strongly agree | 117 | (72.2) |
| I have a responsibility under Workplace Health and Safety procedures to protect me from the sun | | |
| Strongly disagree/ disagree | 6 | (3.7) |
| Neither agree nor disagree | 5 | (3.1) |
| Agree/ strongly agree | 138 | (85.2) |
| My colleagues generally believe that tanned skin looks healthy | | |
| Strongly disagree/ disagree | 71 | (43.8) |
| Neither agree nor disagree | 33 | (20.4) |
| Agree/ strongly agree | 45 | (30.2) |
| I would not use sunscreen regularly because I like to be tanned | | |
| Strongly disagree/ disagree | 133 | (82.1) |
| Neither agree nor disagree | 6 | (3.7) |
| Agree/ strongly agree | 10 | (6.2) |
| I would not wear long sleeves or long pants in the sun because it would prevent me from getting 'some colour' | | |
| Strongly disagree/ disagree | 139 | (85.8) |
| Neither agree nor disagree | 3 | (1.9) |
| Agree/ strongly agree | 7 | (4.3) |

^a Some variables have missing data. ^b New Zealand, United Kingdom, United States, Europe.

modelling, workers perceived a greater level of workplace support for sun protection if they had received formal education on the use of PPE for sun protection ($p=0.001$), or had no history of having a skin spot removed or treated ($p=0.004$), and spent more hours in the sun during a typical work day (Table 5b). The sunburn score and perceived workplace support score did not differ significantly depending on industry type.

Discussion

This study extends previous evidence by assessing sun safety in a diverse sample of workers from small and large workplaces within four outdoor industries. Only half the workplaces surveyed had a specific sun protection policy in place, and just over half of the workers agreed that sun protection was enforced at their workplace. Interestingly, this is similar to findings from a previous mail survey a decade ago which found that 41% of organisations had a sun protection policy³¹. While this highlights that simply by formulating a specific sun protection policy almost half of workplaces could improve on the current status quo, having a policy alone does not ensure uptake of sun protection by workers²⁶. In the current study, having a workplace sun protection policy in place was not

significantly associated with workers' sun protection score, similar to a previous Australian study which compared a workplace with mandatory or voluntary sun protection policies¹⁷. In that study, even in the workplace with a mandatory policy only 69% of workers usually wore a wide-brimmed hat, and 45% usually wore sunscreen¹⁷. However, in the present study, workers who agreed that workplace sun protection was enforced reported a lower sunburn score. Woolley *et al.* found employees of the workplace that had a mandatory sun protection policy had lower rates of solar keratosis (skin cancer precursors) and NMSCs¹⁷. This indicates that enforcing a mandatory sun protection policy could have a measurable effect on workers' actual sun exposure reducing sunburn and skin cancers even if workers do not self-report more protection. Together with the growing legal precedent for workers compensation claims for skin cancer caused by workplace sun exposure³² workplaces should become increasingly interested in comprehensive sun protection policies and procedures to help minimize worker exposure to UVR.

A sun protection policy is considered to provide the foundational framework for the implementation of a range of other risk management strategies such as

Table 3. Worker report of sun protection provided by employer and their frequency of use

| | Provided by employer N (%) | How often used during a typical work week (n, %) | | |
|---|-------------------------------|--|-----------|--------------------|
| | | Never/ Rarely | Somewhat | Usually/ Always |
| Avoiding the sun | | | | |
| Natural shade | 56 (34.6) | 69 (42.6) | 46 (28.4) | 47 (29.0) |
| Artificial shade | 54 (33.3) | 118 (72.8) | 26 (16.0) | 18 (11.1) |
| Restricting amount of time spent in sun between 10 am–3 pm* | — | 132 (81.5) | 12 (7.4) | 17 (10.5) |
| Personal Protective Equipment | | | | |
| Hat (any kind) | 142 (87.7) | 8 (4.9) | 14 (8.6) | 140 (86.4) |
| Hard hat | 117 (72.2) | 102 (63.0) | 24 (14.8) | 36 (22.2) |
| Hard hat with brim | 93 (57.4) | 123 (75.9) | 10 (6.2) | 29 (17.9) |
| Hard hat with brim and flaps | 85 (52.5) | 135 (83.3) | 9 (5.6) | 18 (11.1) |
| Broad brimmed (min 8 cm) hat | 111 (68.5) | 57 (35.2) | 17 (10.5) | 88 (54.3) |
| Other hats (including caps) | 48 (29.6) | 102 (63.0) | 18 (11.1) | 42 (25.9) |
| Long-sleeved, collared shirt | 137 (84.6) | 33 (20.4) | 9 (5.6) | 120 (74.1) |
| Long trousers | 101 (62.3) | 40 (24.7) | 22 (13.6) | 100 (61.7) |
| Enclosed boots/shoes | 116 (71.6) | 1 (0.6) | 2 (1.2) | 159 (98.1) |
| Sunglasses | 121 (74.7) | 23 (14.2) | 17 (10.5) | 122 (75.3) |
| Sunscreen* | 151 (93.2) | 30 (18.5) | 65 (40.1) | 65 (40.1) |

*Missing 1 participant.

Table 4. Significant relationships to sun protection score^a

| | n ^c | Univariate | | Multivariable ^b | |
|---|----------------|----------------------------------|---------|----------------------------------|---------|
| | | Mean sun protection score (S.E.) | p-value | Mean sun protection score (S.E.) | p-value |
| Worker reported they have received formal education/training on the use of PPE for sun protection | | | <0.001 | | <0.001 |
| Yes | 106 | 3.57 (0.07) | | 3.68 (0.11) | |
| No | 56 | 3.12 (0.09) | | 3.13 (0.10) | |
| Skin after exposure to strong sun for 30 minutes without protection | | | 0.065 | | 0.027 |
| Burn without tanning afterwards | 29 | 3.70 (0.13) | | 3.68 (0.15) | |
| Burn then tan | 73 | 3.35 (0.08) | | 3.26 (0.10) | |
| Tan without burning | 56 | 3.37 (0.09) | | 3.28 (0.11) | |
| Being in the sun during work is one of my biggest concerns | | | 0.001 | | 0.003 |
| Strongly disagree/disagree | 68 | 3.17 (0.08) | | 3.12 (0.09) | |
| Neither agree nor disagree | 13 | 3.34 (0.19) | | 3.60 (0.21) | |
| Agree/strongly agree | 68 | 3.63 (0.08) | | 3.51 (0.10) | |
| Workplace size | | | 0.092 | | 0.022 |
| Small | 48 | 3.25 (0.10) | | 3.80 (0.19) | |
| Large | 102 | 3.46 (0.07) | | 3.01 (0.20) | |
| Workplace provides formal education/training on the use of PPE for sun protection | | | 0.040 | | 0.022 |
| No | 44 | 3.20 (0.11) | | 3.00 (0.20) | |
| Yes | 145 | 3.47 (0.07) | | 3.81 (0.18) | |

^a Scale 1–5, higher scores indicate more frequent use of sun protection methods. ^b Including all variables in table, adjusting for age.^c Some variables have missing data. S.E.: standard error.

Table 5a. Significant relationships to sunburn score^a

| | N ^d | Univariate Mean sunburn score (S.E.) | <i>p</i> -value | Multivariable ^c Mean sunburn score (S.E.) | <i>p</i> -value |
|---|----------------|---|-----------------|---|-----------------|
| Amount of time spent in the sun on a typical work day | | | 0.016 | | 0.010 |
| 3 hours or less/day | 33 | 1.58 (0.18) | | 1.56 (0.19) | |
| 3–6 hours/day | 29 | 1.86 (0.19) | | 1.89 (0.20) | |
| 6 or more hours/day | 98 | 2.15 (0.10) | | 2.15 (0.13) | |
| Currently concerned about a spot/mole | | | 0.034 | | 0.013 |
| No/unsure | 125 | 1.89 (0.17) | | 1.63 (0.18) | |
| Yes | 37 | 2.30 (0.09) | | 2.11 (0.12) | |
| Sun protection is enforced at my workplace | | | 0.038 | | 0.055 |
| Strongly disagree/disagree | 45 | 2.20 (0.11) | | 2.12 (0.15) | |
| Neither agree nor disagree | 15 | 1.43 (0.27) | | 1.48 (0.26) | |
| Agree/strongly agree | 90 | 1.89 (0.11) | | 1.95 (0.13) | |

Table 5b. Significant relationships to perceived workplace support score^b

| | | | | | |
|---|----|-------------|--------|-------------|--------|
| Worker reported they have received formal education and training on the use of PPE for sun protection | | | <0.001 | | <0.001 |
| No/unsure | 53 | 3.38 (0.08) | | 3.40 (0.08) | |
| Yes | 94 | 3.82 (0.06) | | 3.81 (0.07) | |
| Has had a skin cancer/mole/spot removed or treated in the past | | | 0.049 | | 0.005 |
| No/unsure | 84 | 3.75 (0.61) | | 3.75 (0.07) | |
| Yes | 63 | 3.55 (0.63) | | 3.46 (0.08) | |
| Amount of time spent in the sun on a typical work day | | | 0.008 | | 0.009 |
| 3 hours or less/day | 31 | 3.41 (0.11) | | 3.39 (0.10) | |
| 3–6 hours/day | 28 | 3.91 (0.11) | | 3.86 (0.11) | |
| 6 or more hours/day | 88 | 3.67 (0.06) | | 3.57 (0.06) | |

^a Scale 1–5, higher scores indicate greater frequency and/or severity of sunburns in the past 12 months. ^b Scale 1–5, higher scores indicate greater perceived value placed on sun protection in in workplace. ^c Including all variables in table, adjusting for age. ^d Some variables have missing data. S.E.: standard error.

environmental/structural changes or providing PPE or education. In the present study, half the workplaces reported providing shade, but only one in ten workers reported using it usually or always. Similarly, only 18% of workers reported limiting their exposure to the sun between the hours of 10 am and 3 pm. Previous studies have reported similarly small proportions of outdoor workers limiting their UVR exposure in these ways^{15, 33, 34}). Glanz *et al.* 2007 suggested this may be due to the nature of the workforce²⁶), however optimal scheduling even of workers' lunch breaks could have a profound effect on exposure levels³⁵), although this has not yet been tested in a randomized fashion.

Compared to structural and environmental provisions, PPE was provided much more frequently by employers in the present study; however again this alone did not ensure uptake. For example, while almost all workers were supplied with sunscreen by

their employer, it was the least frequently used PPE, consistent with several other studies in construction, transport and farming^{16, 17, 33, 36, 37}). Applying sunscreen can be perceived as time consuming and uncomfortable due to greasiness or increasing sweatiness³⁸). Increasing the variety of sunscreens available to workers, or testing the various sunscreens to determine a preferred type could increase uptake in work places.

Having received education on PPE was associated with workers' self-reported usual level of sun protection and sunburn score. A New Zealand study found neither workplace policy, equipment provision, nor scheduling or training influenced worker sun protection¹⁸), but reported that an important correlate of sun protection was perceived workplace support. In the current study, having received workplace education was associated with a higher perceived level of workplace support, which in turn helped workers to

engage in more frequent use of sun protection. A study of British construction workers also found sun protection education was correlated to workers' use of sun protective measures¹⁵⁾, highlighting the value of education and incentives. Our finding that workers in smaller organisations used more sun protection once adjusted for education received could indicate that flatter organisational structures may allow for better support or education delivery.

Similar to other studies^{6, 18, 39)}, personal worker characteristics were associated with use of sun protection, pointing to the importance of individual choice and responsibility. In particular, workers concerned about the health effects of sun exposure and those with fair phenotypes used more sun protection. While some previous studies have found skin cancer risk factors (e.g. skin type) did not affect sun protective behaviors in outdoor workers, the relationship is inconsistent across studies^{33, 40)}.

Limitations

These results provide further evidence for the complex interplay of factors relating to why outdoor workers do, or do not, protect themselves from UVR, but some limitations need to be noted. Firstly, this study used a convenience sample of workers, approaching only those available to also participate in discussion groups. This may have made it less likely for shift workers or those on long-distance assignments to participate, impinging generalizability. Secondly, while the outdoor workforce has a large proportion of workers with low literacy, most workers had at least some high school education. Those with lower levels of education may have been reluctant to participate, and our findings may overestimate sun protection and perceived workplace support. Third data was based on self-report, associated with common biases such as social desirability bias.

Conclusions

This paper provides a picture of baseline levels of usual sun protection, sunburn at work, and perceptions of workplace support among workers at 15 workplaces in Queensland, Australia. In summary, while some of the 15 workplaces had a sun protection policy and provided shade and PPE, these activities did not necessarily ensure a high level of sun protection by employees. The results suggest policy enforcement, education/training on the use of PPE for sun protection, and modelling by supervisors may assist to further to increase perceived support for sun safety which in turn is needed to further improve sun protection. This data, along with qualitative data from discussion groups and informal discussions with workers and workplace champions, were used to

plan targeted, multi-component interventions for each workplace using a PAR framework. Further details of intervention results will be described in future publications.

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