



Occupational Health Action Plan  
Workplace Health and Safety Policy  
Department of Labour  
P O Box 3705  
Wellington 6011

16 November 2011

**"Submission on the Occupational Health Action Plan 2011-13"**

This submission is from  
The Cancer Society of New Zealand  
P O Box 17200,  
Thorndon  
Wellington, 6144

Contact person:  
Dr Jan Pearson  
Deputy Chief Executive/Health Promotion Manager  
[jan.pearson@cancer.org.nz](mailto:jan.pearson@cancer.org.nz)  
DDI 04 4947276  
Mobile: 0274517359

To whom it may concern,

The Cancer Society of New Zealand is a non-profit organisation which aims to minimise the incidence and impact of cancer on all those living in New Zealand.

We commend you on your plan to protect New Zealand workers in the occupational setting especially the actions to address Occupational Carcinogens. We consider, however that there is a gap in your plan as it does not address the need to protect New Zealand workers, especially those employed in outdoor occupations, from the sun. We are concerned about the damage that can occur from excessive exposure to sun exposure and Ultra Violet Radiation (UVR) which in New Zealand in summer months can cause skin damage that can lead to skin cancers.

*‘Skin cancer is the most common cancer in New Zealand with around 1,800 new melanoma cases reported and, based on extrapolation from regional laboratory data, at least 45,000 new cases of non-melanoma skin cancer each year (O’Dea, 2000). Outdoor workers are considered to be at a particularly high risk of developing both malignant melanoma and non-melanoma skin cancer, due to their potentially high sun-exposure (Woolley, Buettner & Lowe. 2002; Stepanski & Mayer, 1998) Outdoor workers make up a significant proportion of the New Zealand workforce (14.5%) (Department of Labour, 2006) and workplace safety concerns drive the need for effective strategies to improve workers’ sun protection<sup>1</sup>’.*

You state in your plan that the most effective strategy to reduce occupation cancer is reducing the carcinogenic substances in the workplace. In the case of skin cancer in outdoor occupations this is not possible however protection from UVR is possible with adequate support from employers with policies, protective clothing and support for appropriate practices by all workers and managers.

We urge you to seriously consider inclusion of this risk in your plan.

We consider that if protection from Skin Cancer was to become part of your plan the issue would be taken more seriously by both employers and workers and we would be able to take a more concerted approach to reducing the incidence and impact of skin cancer in New Zealand.

I have enclosed some relevant information including:

- a paper on patterns of real-time occupational UVR exposure among a sample of outdoor workers in New Zealand,
- a press release and front section of report on the cost of Skin Cancer in New Zealand (please contact me for a copy of the full report), and
- some resources we have developed for use by outdoor workers and companies that employ them.

I would be very happy to come and meet with the group considering submissions to explain and expand on our concerns and some of the activities we have been involved in to mitigate this risk to New Zealand workers.

Yours Sincerely

Dr Jan Pearson

---

<sup>1</sup> Judith P McCool, Des F Gorman MD, Anthony I Reeder PhD, Elizabeth M Robinson and Keith J Petrie. *Outdoor workers’ perceptions of risk of sun-exposure and use of sunscreen*

## **Outdoor workers' perceptions of risk of sun-exposure and use of sunscreen**

**Judith P McCool, Des F Gorman MD, Anthony I Reeder PhD, Elizabeth M  
Robinson and Keith J Petrie**

Judith McCool, Keith Petrie, Department of Psychological Medicine, Faculty of Medical and Health Sciences, University of Auckland.

Des Gorman, Department of Occupational Medicine, School of Population Health, Faculty of Medical and Health Sciences, University of Auckland.

Anthony Reeder, Social & Behavioral Research in Cancer Group, Department of Preventive & Social Medicine, Dunedin School of Medicine, University of Otago.

Elizabeth Robinson, Department of Epidemiology and Biostatistics, School of Population Health, University of Auckland.

Correspondence concerning this article should be addressed: Judith McCool, Psychological Medicine, Faculty of Medical and Health Sciences, University of Auckland, New Zealand. Email: [j.mccool@auckland.ac.nz](mailto:j.mccool@auckland.ac.nz)

### **Abstract**

Skin cancer is the most common cancer in New Zealand with around 1,800 new melanoma cases reported and, based on extrapolation from regional laboratory data, at least 45,000 new cases of non-melanoma skin cancer each year. In this study we assessed the relationship between attitudes towards sun-exposure, risk of developing skin cancer and sunscreen use among outdoor workers. We surveyed 1,131 New Zealand outdoor workers to assess the socio-demographic and occupational group differences in sunscreen use. We found that sun-exposure risk perceptions and attitudes were strongly associated with sunscreen use behaviour. Multiple regression analyses revealed sun protection use was associated with concern about sun-exposure, a supportive workplace culture and high perceived level of knowledge about sun-exposure. The results support the need to target risk perceptions in order to increase sun protection use among outdoor workers.

## **Outdoor workers' perceptions of risk of sun-exposure and use of sunscreen**

Skin cancer is the most common cancer in New Zealand with around 1,800 new melanoma cases reported and, based on extrapolation from regional laboratory data, at least 45,000 new cases of non-melanoma skin cancer each year (O'Dea, 2000). Outdoor workers are considered to be at a particularly high risk of developing both malignant melanoma and non-melanoma skin cancer, due to their potentially high sun-exposure (Woolley, Buettner & Lowe, 2002; Stepanski & Mayer, 1998). Outdoor workers make up a significant proportion of the New Zealand workforce (14.5%) (Department of Labour, 2006) and workplace safety concerns drive the need for effective strategies to improve workers' sun protection. Past research into sun-exposure and sun-protection among outdoor workers indicates that they tend to be reluctant users of sun-protection, and tend not to be well informed of the effects of cumulative sun-exposure (Dobbinson & Knight 2001; Woolley et al., 2002). As sun-exposure is widely accepted to be a primary predictor of skin cancer, this study assesses how outdoor workers perceive their personal risk of developing skin cancer, and how these perceptions relate to sunscreen use.

The epidemiology of basal cell carcinoma has some similarity to melanoma in that childhood and recreational sun exposure are strong predictors, whereas squamous cell carcinoma is associated with cumulative and occupational exposure (Krickler, Armstrong, English & Heenan, 1995). Skin cancer risk is also associated with skin type, especially fair skin, a history of episodes of sunburn, and non-malignant solar damage (Green, Battistrutta & Hart, 1996). Although at least one study has failed to find any evidence of association between occupation and skin cancer in an Australian population (Green et al., 1996) a number of other studies have found that the risk of developing skin cancer is related to the amount of time spent outdoors unprotected from sun exposure (Marks, Staples, Giles, 1993; Dallas, Armstrong & Krickler, 1998). Outdoor workers are considered to be at a particularly high risk of developing

non-melanoma skin cancer, especially those who have fair skin yet do not use effective sun-protection (Woolley et al., 2002). Although outdoor workers generally receive a higher level of sun-exposure, their pattern of sun-protection is reported to be similar to that of indoor workers (Woolley et al., 2002). Improving sun-protection among people who work outdoors, and as a consequence experience higher levels of sun-exposure, is a primary public health, and occupational health issue.

In previous qualitative research we explored outdoor workers' understandings of the risks associated with occupational sun exposure (McCool, Gorman, Reeder & Petrie, in submission). A qualitative study, using a focus group methodology was conducted to explore the socio-cultural and workplace factors surrounding workers perceptions of risk of sun-exposure and skin cancer. In this study we explored how outdoor workers construct perceptions of their risk of developing skin cancer and to describe the social, lifestyle or workplace environment factors which influence the prioritization of sun protection behaviors. Findings showed that outdoor workers hold beliefs about their own resilience to sun exposure that did not necessarily fit with existing models of health behaviour such as the Theory of Planned Behaviour (Myers & Horswill, 2006). Outdoor workers risk attitudes were associated with factors such as perceived innate immunity; past sun-exposure; perceived normalcy of risk and competing workplace priorities. In general, outdoor workers expressed a pervasive nonchalant attitude towards working in the sun and a reluctance to use sun protection. Misconceptions about personal resilience to sun damage and a low perceived priority of sun-protection were also evident. Previous studies have identified outdoor workplaces are often not subject to mandatory sun-protection practices (Parrott, Monahan, Ainsworth, Steiner, 1998).

Although a number of studies have described outdoor workers' knowledge and attitudes towards sun-exposure (see Morris & Elwood, 1996), very few studies have assessed how workers develop perceptions of risk and how these risk perceptions relate to sun-protection

behaviour. Although Dobbinson, Knight and Wakefield (2005) included a risk perception item in their study of farmers, we remain uncertain about the critical dimensions within risk perceptions that may influence sun-protection behaviour. Understanding perceptions of risk of sun exposure presents a unique challenge in risk perception research in that sun-exposure is generally understood to be a pleasurable activity, and as was identified in the previous qualitative study, can even enhance the enjoyment of outdoor work. As such, sun exposure presents an ambiguous risk in that the pleasures and benefits from sun exposure often underplay the potentially adverse consequences of neglecting health protective behaviours (sun-protection). We understand from previous research into outdoor workers' sun-exposure beliefs and behaviours, that outdoor workers are typically ambivalent about undertaking sun-protective behaviours; sun exposure is likely to be considered an everyday reality, rather than a "risk" (McCool et al., in submission). In addition to our understanding about the propensity of males and younger people to have perceptions of invulnerability, evidence also suggests that females and older people are more likely to overestimate risk and consequently adopt health protective behaviours (Campbell & Birdsell, 1994; Hill, White, Marks, Theobald, Borland & Roy, 1992).

The majority of risk perception research relies upon the use of risk cognition measures as a way of identifying determinants of protective – or risky behaviours. This survey was developed from a formative qualitative study; accordingly, these dimensions differ from those identified within other health behaviour models, including protection motivation theory (Rogers, 1993) or Theory of Planned Behaviour (Myers & Horswill, 2006) and reflect pervasive risk-relevant attitudes and behaviours specific to the outdoor occupational setting. These constructs were developed into measures to be used in the questionnaire to assess outdoor workers unique appraisals of sunburn experiences, perceived resilience to sunburn, perceived priority of sun-protection within the work context and concern about sun-exposure. In addition, other contextual factors, including attitudes towards suntanning, workplace culture (support) and general knowledge about the effects of sun-exposure reflect beliefs about the risks associated with sun-exposure.

Hypotheses are based on the expectation that sun-exposure is patterned according to socio-demographic factors and is expected to be higher among some outdoor occupations where there is little respite from exposure (e.g. forestry as opposed to postal work). Sunscreen use is anticipated to be associated with attitudes and beliefs about personal risk and vulnerability to sunburn, and skin cancer. These have been expressed in the theoretical constructs assessed as independent measures in the multivariate regression model.

The aims of the study were to assess factors that predict outdoor workers appraisals of their personal risk of developing skin cancer and secondly to assess the effect of socio-demographic variables (gender, ethnicity, age, education) on outdoor workers perceptions of their risk of developing skin cancer. The focus of the present study was intentionally on outdoor workers' perceptions of the risk of developing non-melanoma skin cancer, which for the purpose of the survey was referred to as "skin cancer". To address the aims of the study, the following hypotheses are proposed:



1. Risk perceptions will differ according to age level, gender, ethnic group, occupational group and education.
2. Sunscreen use will be associated with perceived priority of sun-protection, perceived resilience to sunburn, high concern about skin cancer, low preference for sun-tanning and low perceived knowledge about skin cancer.

## Method

### *Participants:*

Outdoor workers from a range of occupational groups (N = 1131) participated in the study. The sample comprised 178 road construction workers, 167 landscape gardeners, 123 postal workers, 112 horticulture workers, 120 sawmillers, 116 farmers, 102 building construction workers, 101 forestry workers and 85 viticulture workers. The majority of the participants were male (67.3%) and their ages ranged from 15 to 75 years (mean 37 years). The ethnic mix of the sample was made up of New Zealand European (44.9%), Maori (23.3%), Pacific Island (5.4%), Asian (1.8%), and people from other ethnic groups (6.4%).

### *Procedure:*

The nine outdoor occupational groups were selected on the basis of their high potential for sun exposure. A clustered survey design was employed and suitable individual employers or companies were selected from current trade directories. A letter was sent to the workplace manager outlining the study intentions and requirements for participation. Follow-up phone calls were made to discuss the participation criteria. With the permission of the company manager, information sheets containing details about the study were made available to all outdoor working employees. Farmers were accessed and surveyed, on site, at regional livestock sale venues. The questionnaire was distributed and completed on site in the New Zealand summer between February and April 2004. The overall response rate to the questionnaire from

workers identified as eligible for inclusion in the study was 73.5% (ranging from 79.4% for landscaping to 60.5% for viticulture). The study was approved by the University of Auckland Human Participants' Ethics Committee.

*Measures:*

A 40-item questionnaire was developed to assess outdoor workers' sunscreen use, sun exposure and perceived risk of developing skin cancer from established scales and new measures developed from the qualitative study. To ensure consistency with other New Zealand and international studies, standardized measures of risk according to skin type, (Fitzpatrick, 1988) and socio-demographic variables were included in the questionnaire and ethnicity and education were measured according to the New Zealand census categories (Statistics New Zealand, 2006). Participants were also asked for duration of sun exposure and outdoor employment through two items

Sunscreen use was assessed by two questions: "Do you use sunscreen when you work outdoors in summer?" and "Do you use sunscreen when you work outdoors in winter?" (both rated on a 5-point scale from "never" to "nearly always"). The sunscreen use items were summed to create a total sunscreen use score. The measure are normally distributed with scores from a range from 2 to 10, the mean score was 4.2,  $SD = 2.0$ . Cronbach's alpha for this scale was .69.

---

Table 1 about here

---

Risk perception measures were developed based on constructs extrapolated from the formative qualitative study. These included: perceived skin type, prioritization of sun protection, perceived resilience to sunburn, sun exposure concern, attitudes towards

suntanning, workplace culture and perceived knowledge (see Table 1). The questionnaire was pilot tested with a sample of forestry workers to assess comprehension and length of questionnaire. As part of the questionnaire development, a factor analysis and principal components analysis were conducted with the pilot data to eliminate any redundant or weak items within each sub-scale (table 1). Measures were assessed using a 5-point likert scale from “strongly agree” to “strongly disagree”, with the exception of the knowledge score which used a three-point likert scale from “nothing at all” to “a lot”. The alpha coefficients for the measures ranged from .72 to .84.

## Results

### *Risk perceptions measures*

Correlation analysis revealed low to moderate significant correlations between the risk perception measures, with coefficients ranging from .07 to .52. Among the moderate correlations were concern about sunburn and perceived priority of sun-protection ( $r = .52$ ); resilience and priority ( $r = .47$ ), and resilience and perceived skin type ( $r = .48$ ) (see Table 2).

---

Insert Table 2 about here

---

### Between groups analysis

#### *Perceived skin type*

Workers who were young, male and Maori, were significantly more likely to report that their skin didn't burn, when compared with their colleagues who were older ( $F(5, 966) = 6.60, p < .0001$ ); female ( $F(1, 96) = 40.13, p < .0001$ ); and of New Zealand European ethnicity ( $F(5, 966) = 6.14, p < .0001$ ). There was evidence of a difference between occupational groups for perceived skin type ( $F(8, 966) = 2.03, p = 0.05$ ), (forestry highest) and a significant difference

between educational groups for perceived skin type ( $F(1, 966) = 2.16, p=0.1$ ) (lower educated higher).

*Perceived priority of sun-protection in the workplace*

A significant main effect observed was that workers who were older, female, New Zealand European, and with higher educational achievement were significantly more likely to prioritize sun-protection than their colleagues who were younger ( $F(5, 972) = 2.74, p<.01$ ); male ( $F(1, 972) = 41.34, p<.0001$ ); Maori ( $F(5, 96) = 5.64, p<.001$ ); and had lower educational achievement ( $F(1, 972) = 5.10, p<.05$ ). A significant difference was detected between occupational groups for perceived priority of sun-protection; ( $F(8, 972) = 5.03, p<.001$ ), with postal workers most likely to see it as a priority and forestry workers to rate it lower.

*Cultivated resilience to sun exposure*

Between-groups analysis indicated a significant main effect for age and gender, with male workers and younger workers significantly more likely than the female ( $F(1, 981) = 45.34, p<.001$ ), and older workers ( $F(5, 981) = 5.21, p<.001$ ), to perceive that sun-exposure enhances resilience to the effects of sun-exposure. Workers from the postal and sawmilling industries were less likely, and forestry workers more likely, than the other occupational groups to perceive that sun-exposure enhances resilience; ( $F(8, 981) = 4.31, p<.001$ ). There were some differences among ethnic groups with Maori and Pacific workers more likely than their New Zealand European colleagues to believe that sun exposure was protective ( $F(5, 981) = 2.41, p<.05$ ). No significant main effects were identified for educational level ( $F(1, 981) = 1.60, p=0.2$ ).

*Concern about sun-exposure*

Workers who were young, Maori, male, had received less formal education, and worked in the postal, viticulture or landscaping industries were less likely to report concern about sun-

exposure than workers who were older ( $F(5, 987) = 6.68, p < .0001$ ), of New Zealand European ethnicity ( $F(5, 987) = 6.15, p < .0001$ ); female ( $F(1, 987) = 30.14, p < .0001$ ); more highly educated ( $F(1, 987) = 16.97, p < .001$ ), or from the other occupational groups ( $F(8, 987) = 4.71, p < .0001$ ).

#### *Suntanning*

A significant main effect was noted for age, with both the youngest (15 – 30 years,  $n = 330$ ) and the oldest (60 years and over,  $n = 200$ ) age groups more likely to hold positive views of suntanning compared to the middle age group (31 – 60 years,  $n = 526, F(5, 973) = 5.21, p < .001$ ). Sawmilling workers were less likely to report positive beliefs about suntanning compared to all other occupational groups; ( $F(8, 973) = 3.72, p < .001$ ). No significant differences were observed for gender ( $F(1, 96) = 0.60, p = 0.4$ ), education ( $F(1, 96) = 0.78, p = 0.4$ ) or ethnic group ( $F(5, 973) = 1.81, p = 0.1$ ).

#### *Workplace Culture*

Female workers, older workers, and workers from the postal, landscaping and viticulture industries were more likely to report a supportive workplace culture compared to males ( $F(1, 966) = 20.67, p < .001$ ); younger workers; ( $F(5, 966) = 5.16, p < .001$ ); other occupational groups ( $F(8, 966) = 6.90, p < .001$ ); and New Zealand European workers ( $F(5, 966) = 4.45, p < .001$ ).

#### *Perceived knowledge about sun-exposure*

Further analysis identified that older worker, females, workers from the viticulture, landscaping and postal industries, and workers with higher education levels were more likely to report knowledge about sun-exposure compared with younger workers ( $F(5, 960) = 10.99, p < .001$ ); males ( $F(1, 960) = 20.03, p < .001$ ); workers from all other groups ( $F(8, 960) = 7.39, p < .001$ ); and workers with lower education ( $F(1, 960) = 6.82, p < .01$ ). No significant differences between ethnic groups were observed ( $F(5, 960) = 0.99, p = 0.4$ ).

### *Sunscreen use*

The results indicate that female workers; ( $F(1, 794) = 46.11, p < .001$ ) and workers in older age levels; ( $F(5, 794) = 3.90, p < .001$ ), were more likely to use sunscreen than males and younger workers. There were significant differences in sunscreen use across the occupational groups with workers from the viticulture and postal industries more likely to use sunscreen than workers from all other outdoor occupational groups; ( $F(8, 794) = 5.81, p < .001$ ). New Zealand European workers were also more likely to use sunscreen compared to Maori workers; ( $F(5, 794) = 6.14, p < .001$ ). Workers with higher education were more likely to use sunscreen than those with lower education; ( $F(1, 794) = 7.26, p = 0.008$ ).

### *Multivariate Analysis*

A multivariate linear regression analyses identified that after controlling for socio-demographic variables, several risk perception variables showed a strong and independent relationship with sunscreen use [Table 3]. Specifically, priority ( $p < .05$ ), concern ( $p < .001$ ), work culture ( $p < .001$ ), and knowledge ( $p < .001$ ) were all found to influence the use of sunscreens. Perceptions of skin type ( $p = 0.7$ ), sun tanning ( $p = 0.06$ ) and resiliency ( $p = 0.2$ ) were not found to have an effect. Overall, 37% of the total variance for sunscreen use was explained by the model.

---

Table 3 about here

---

### Discussion

The findings from this study indicate that outdoor workers' concern about sun-exposure; supportive workplace culture and perceived knowledge about the effects of sun-exposure were strongly and independently related to sunscreen use. Perceived priority and

resilience to sun-exposure and perceived skin-type (perceived propensity to sunburn) were not associated with sunscreen use. Differences between workers from the viticulture, landscaping and postal industries when compared with other occupational groups workers were particularly notable across all risk perception measures. The more equitable gender ratio evident with the postal industry (61% female) did not explain the difference for this group, but a smaller proportion of females than males worked in both the landscaping and viticulture companies. It is possible that a higher proportion of females in the workforce may introduce greater diversity from the dominant representation of traditional male values evident within the outdoor occupational context. However, further research is necessary to develop a clearer understanding of which factors distinguish these groups.

A significant main effect for gender was observed across all risk perception measures, and for sunscreen use. These findings are consistent with earlier qualitative research which also identified that outdoor workers were, predominantly, nonchalant about sun-exposure as a workplace risk. Although we did not directly assess the “macho effect”, earlier work identified that the dominance of males in outdoor occupations tends to be associated with the characteristic *machismo* cultural patterns related to working in harsh physical conditions. It is possible that the outdoor working environment fosters a culture in which health protective behaviors are undermined, due to a pervasive belief in personal resilience to harm (Pritchard & McCarthy, 2002). A study of 21-year-old New Zealanders also found that women were more vigilant about preventative health care practices compared to men (Douglass, McGee & Williams, 1998) which may have an impact on the sun-protection use in a workplace.

Results from this study indicate that perceptions and practices among younger workers followed similar patterns to those found for males, with the younger workers more likely than their older colleagues to have less protective attitudes and, in addition, less likely to use sunscreen, except workers from the oldest age category. These findings are consistent with the

previous qualitative research which suggests that as older workers are more likely to have experienced skin cancer, either personally or within their families, they may be more aware of the negative effects of excess sun-exposure. However, other research found little evidence that older age groups were more responsive to the warning signs of skin damage, or were more protective about their health than younger workers, on the basis of their experiential knowledge, (Woolley et al., 2002; Parrott et al., 1998). Furthermore, previous studies have also found that young people are more likely to value the perceived short-term benefits of suntanning and hold misconceptions about personal resilience to sun-damage than older adults (Boldeman, Branstrom & Dal, 2001).

Lower educational attainment was positively associated with perceptions of invulnerability. The association between education and awareness of risk and sun-protection behavior is not well researched in the sun-protection literature. However, it may be that individuals with higher levels of formal education are less likely to accept dominant misconceptions about sun-exposure and more likely to access and incorporate objective risk information into their work practices (Douglass, McGee & Williams, 1997). Research by Douglass and colleagues found that level of knowledge (rather than educational attainment) was associated with sunscreen use among young people (Douglass et al., 1998).

Studies of sun-protection behaviors in other populations have found evidence of optimistic bias when assessing the personal risks associated with excess sun exposure. Adolescents, for example, are particularly susceptible to underestimating the risks associated with sun tanning (Davis, Winkleby & Farquhar, 1995). Maori, the indigenous people of New Zealand, tend to report significantly lower rates of skin cancer, due to their lower skin-sensitivity compared with the European population of New Zealand (Reeder, 2001). This understanding is widely accepted in the outdoor worker community; with qualitative findings



suggesting that Maori were generally ambivalent about sun-protection use, due to their perceived immunity from sun damage.

This study found that being employed in a workplace that was perceived to be supportive of sun-protection was associated with sunscreen use. However, Maori and younger workers were less likely to report that their workplaces were supportive compared to other groups. It has been suggested that interventions need to work from a workplace structural level to support effective sun-protection interventions (Woolley et al., 2003). The results of the present study highlight the potential value of using informal workplace networks as vehicles of dissemination. It is possible, therefore, that existing worker and management networks, using credible advocates or ‘champions’, may be the most practical and influential means of disseminating information about sun exposure and appropriate protection (Gellar, Glanz & Shigaki, 2001; Stephanski & Mayer, 1998). In essence, effective intervention requires a multifaceted approach, addressing both personal and structural (policy, organizational and work culture) factors in facilitating positive perceptual and behavioral change.

Finally, the results from this study should be considered in light of the limitations of the study design. Specifically, data on non-responders was not-systematically collected, therefore we can not rule out a selection bias in the sample. Despite the large sample size, selection bias is also possible in that only workers who were present at work on the day of sampling were invited to participate in the study. It is possible therefore that those who participated may be less likely to undertake risky behaviours resulting in an exaggerated reporting of sunscreen use. Moreover, although overall high response rate is reassuring that data collected is representative of the majority of outdoor workers across the occupational groups, stratified analysis challenge the achievement of significant results, which may be achieved in a sample with greater power. Although the questionnaire was developed out of a formative qualitative study, the translation of the risk perception constructs to a structured questionnaire format was problematic for some

groups and assistance was occasionally sought from the research assistant to clarify meaning of some items. In essence, among workers, the verbal word is more accessible (and valued) than the written word, particularly in the context of seeking opinions or attitudes. Future research on this issue with outdoor workers would benefit from using more refined (brief) survey instruments or continue to work with qualitative data collection methods to enhance the validity of data. Future studies should also address the role of general working conditions (e.g. time and performance pressures, other chemical or physical exposures) on sunscreen use.

Despite investment to increase awareness of skin cancer risk and the need for sun protection among the general population, outdoor workers represent a large, and unique population group which, judging on the basis of the results of the present study, hold largely ambivalent views towards sun-exposure and sun-protection (Parrott et al., 1998). Given the high potential sun-exposure experienced by outdoor workers, population-based interventions which are strongly grounded in the role of risk perceptions offer practical and theoretically guided avenues for intervention. Results indicate that risk perceptions probably play a vital role in establishing and maintaining sun-protective behaviors.

## References

- Boldeman, C., Branstrom, R., & Dal H. (2001). Tanning habits and sunburn in a Swedish population age 13-50 years. *European Journal of Cancer*, 37, 2441-8.
- Bryman, A., & Cramer, A. (1997). *Quantitative data analysis with SPSS for windows: a guide for social scientists*. London: Routledge.
- Campbell, H. S. & J. M. Birdsell (1994). Knowledge, beliefs, and sun protection behaviours of Alberta adults. *Preventive Medicine* 23(2): 160-166.
- Dallas, E., Armstrong, B., & Krickler, A. (1998). Demographic characteristics, pigmentary and cutaneous risk factors for squamous cell carcinoma of the skin: a case-control study. *International Journal of Cancer*, 76, 628-634.
- Davis, S., Winkleby, M., & Farquhar, J. (1995). Increasing disparity in knowledge of cardiovascular disease risk factors and risk-reduction strategies by socio-economic status: implications for policy-makers. *American Journal of Preventive Medicine*, 11, 318-323.
- Department of Labour, New Zealand. (2005). Labour Market Information. Retrieved June 19, 2006. Access: <http://www.dol.govt.nz/services/LMI/index.asp>
- Dobbinson, S., & Knight K. (2001). Protecting workers from ultraviolet radiation in sunlight. *Journal of Occupational Health and Safety*, 17, 587-9.
- Dobbinson, S., Doyle, C., & Wakefield, M. (2005). Farmers' and outdoor workers' beliefs about skin cancer and protection from summer sun: a brief report. *The Cancer Council*. Melbourne, Victoria, Australia.
- Douglass, H., McGee, R., & Williams S. (1997). Sun behaviour and perceptions of risk for melanoma among 21-year-old New Zealanders. *Australian & New Zealand Journal of Public Health*, 21, 329-34.
- Douglass, H.M., McGee, R., & Williams, S. (1998). Are young adults checking their skin for melanoma? *Australian & New Zealand Journal of Public Health*, 22, 562-7.

- Fitzpatrick, T. P. (1998). The validity and practicality of sun-related skin types I through VI. *Archives of Dermatology*, 869-871.
- Geller, A., Glanz, K., & Shigaki, D. (2001). Impact of skin cancer prevention on outdoor aquatics staff: the Pool Cool program in Hawaii and Massachusetts. *Preventive Medicine*, 33, 155-161.
- Green, A., Battistutta, D., & Hart, V. (1996). Skin cancer in a subtropical Australian population: incidence and lack of association with occupation. *American Journal of Epidemiology*, 144, 1034-1040.
- Hill, D., White, V., Marks, R., Theobald, Z T, Borland, R., & Roy, C. (1992). Melanoma prevention: behavioural and nonbehavioural factors in sunburn among an Australian urban population. *Preventive Medicine*, 21, 654-669.
- Krickler, A., Armstrong, B., English, D., & Heenan, P. (1995). Does intermittent sun exposure cause basal cell carcinoma? A case-control study in Western Australia. *International Journal of Cancer*, 60, 489-494.
- Marks, R., Staples, M., & Giles, G. (1993). Trends in non-melanocytic skin cancer treated in Australia: the second national survey. *International Journal of Cancer*, 53, 585-90.
- McCool, J. P., Gorman, D., Reeder, A., & Petrie K.J. (*in submission*). You've just got to harden up: Outdoor workers' perceptions of the risks of sun exposure.
- Morris, J., & Elwood, M. (1996). Sun exposure modification programmes and their evaluation: a review of the literature. *Health Promotion International* 11, 321-332.
- Myers, L.B., & Horswill, M. (2006). Social Cognitive Predictors of Sun Protection Intention and Behaviour. *Behavioural Medicine*, 32, 57 – 61.
- O'Dea, D. (2001). The costs of skin cancer to New Zealand. *Cancer Update: In Practice*, Cancer Society of New Zealand, Wellington.

- Parrott, R., Monahan, J., Ainsworth, S., & Steiner, C. (1998). Communicating to farmers about skin cancer: the behavioural adaptation model. *Human Communication Research, 24*, 386-409.
- Pritchard, C., & McCarthy, A. (2002). Promoting health in the construction industry? *Journal of Occupational and Environmental Medicine, 44*, 540-545.
- Reeder, A. (2001). Results from the Maori respondents included in the national survey of awareness, understanding and response to sun protection messages in media weather reports: Report to the National Health Promotion Committee of the New Zealand Cancer Society. *Social and Behavioural Aspects of Cancer Group, Department of Preventive and Social Medicine, University of Otago, Dunedin.*
- Reeder, A., & Trevena, J. (2003). Adults' perceptions of the causes and primary prevention of common fatal cancers in New Zealand. *The Medical Journal of Australia, 116*, 1182.
- Rogers, R. W (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology: Interdisciplinary and Applied, 91*, 94-114.
- Rosenman, K. D., Gardiner, J., Swanson, G.M., Mullan, P.B., & Zhu, Z. (1995). Use of skin cancer prevention strategies among farmers and their spouses. *American Journal of Preventive Medicine, 11*, 342-7.
- Shovellor, J., Lovato, C., Young, R., & Moffat, B. (2003). Exploring the development of suntanning behaviour: a grounded theory study of adolescents' decision-making experiences with becoming a sun tanner. *International Journal of Behavioral Medicine, 10*, 299-314.
- Staples, M., Marks, R., & Giles, G. (1998). Trends in the incidence of non-melanocytic skin cancer (NMSC) treated in Australia 1985-1995: are primary prevention programs starting to have an effect? *International Journal of Cancer, 78*, 144-8.

- Statistics New Zealand (2001). The New Zealand Census 2001. *Statistics New Zealand*, Wellington, New Zealand. Accessed June 2, 2006. Access: [www2.stats.govt.nz/domino/external/omni/omni.nsf](http://www2.stats.govt.nz/domino/external/omni/omni.nsf).
- Stepanski, B., Mayer, J. (1998). Solar protection behaviors among outdoor workers. *Journal of Occupational Health and Safety*, 40, 43-8.
- Woolley, T., Buettner, P & Lowe, J. (2002). Sun-related behaviours of outdoor working men with a history of non-melanoma skin cancer. *Journal of Environmental Medicine*, 44, 847-854.

Table 1. Risk and knowledge perception scales

Scale	Alpha	Eigenvalue	Factor loadings
<b>Perceived skin type</b>	.72		
It takes a lot of sun for me to burn		1.9	.80
My skin has become resistant to the sun over time		.56	.81
In the past I have been exposed to the sun and have not got burnt		.49	.78
<b>Priority</b>	.83		
There are more important things to worry about in my life than getting sunburnt		2.6	.79
I have a greater chance of getting injured at work than getting skin cancer from working outside		.53	.81
I am more concerned about workplace injuries (e.g. getting cut) than getting sunburnt		.46	.86
Getting a job completed at work is more important than worrying about getting sunburnt		.31	.79
<b>Resilience</b>	.85		
Getting a tan early in the season will protect my skin throughout summer		2.1	.89
Getting a tan in summer protects my skin from sunburn		.53	.86
I believe that it is safe for skin to be exposed to the sun to develop a tan naturally		.30	.79
<b>Concern</b>	.77		
I am not concerned about my skin being burned at work		2.0	.71
I don't think about the sun until I notice my skin		.65	.88

---

going pink or red			
I don't notice the sun until I feel my skin is burning		.28	.87
<b>Work culture</b>	.76		
Remembering to use sun protection has a high priority within my workplace		2.3	.68
I feel comfortable about applying sunscreen in front of my workmates		.66	.80
I would tell my workmate if I think he/she is getting sunburnt		.49	.78
It is my responsibility to use sun protection (e.g. sun hat, sunscreen etc).		.47	.78
<b>Knowledge</b>	.84		
Thinking about skin cancer, how do you think you know about:			
How to protect yourself from the sun?			
Skin cancer in general?		1.6	.91
Your personal risk of developing skin cancer?		.33	.91
<b>Suntanning</b>	.85		
I try and work on my tan when I am at work		2.7	.73
I feel more healthy with a suntan		5.8	.87
Working outside helps me maintain a good tan		.37	.84
A suntan makes me feel better about myself		.28	.86

---



Table 2. Correlations among risk perception variables.

Variable	1	2	3	4	5	6	7
1. Perceived skin type							
2. Priority	.41**						
3. Resilience	.47**	.46**					
4. Concern	.43**	.52**	.45**				
5. Suntanning	.27**	.22**	.45**	.28**			
6. Work culture	-.17**	-.30**	-.25**	-.31**	-.05		
7. Knowledge	-.15**	-.23**	-.24**	-.25**	-.12**	.28**	
Mean	8.1	11.6	7.4	10.5	15.2	8.7	
SD	2.7	3.5	2.6	3.3	2.6	1.9	

Table 3. Regression analysis for predictors of sun-screen use among outdoor workers' after controlling for socio-demographic variables.

<b>Predictor variables</b>	<b><math>\beta</math> estimate</b>	<b>se <math>\beta</math></b>	<b>t</b>	<b>Total Adjusted <math>R^2</math></b>
Sunscreen Use				.30
Perceived skin type	-.030	.002	-1.24	
Priority	.027	.018	1.50*	
Resilience	-.018	.031	-.059	
Concern	.017	.034	5.02***	
Suntanning	.000	.017	.15	
Work culture	.189	.030	6.21***	
Knowledge	.118	.033	3.49**	

### Acknowledgements

This project was funded by the Cancer Society of New Zealand (Wellington Division Inc.). The authors also wish to acknowledge the support of Dr Kawshi De Silva (formally Cancer Society of New Zealand, Wellington Division Inc.) and Laura Lambie (Cancer Society of New Zealand, Wellington Division Inc.). Dr Reeder and the Social & Behavioural Research in Cancer Group receives support from the Cancer Society of New Zealand and the University of Otago.