Self-reported skin cancer-related behaviours in rural Victoria: results from repeat cross-sectional studies in 2001–2003 and 2016–2018

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Abstract

Objective: To assess whether self-reported use of sun-protective measures and skin examination have changed between 2001 and 2018 in a rural setting.

Methods: Repeat cross-sectional survey of randomly selected households in four rural Victorian towns. People aged 16 years and older were eligible to participate. Logistic regression was used to identify demographic factors associated with sun-protective measures and skin examination.

Results: Overall, 5,328 participated in 2001–2003 and 2,680 in 2016–2018. Among participants who go out in the sun, the mean number of reported sun-protective measures (2.6±1.3 vs. 2.6±1.6, p=0.867) and the proportion of participants reporting usually/always using sun protection (65.1% vs. 63.9%, p=0.307) were unchanged between the two surveys. However, an increased proportion of participants reported avoiding the sun when outdoors in the more recent survey (from 18.8% to 34.3%, p<0.001). Avoiding the sun was associated with being older, female, of European origin and having post-secondary school education. Skin examination rates increased between the two surveys (32.7% to 40.8%, p<0.001). Skin examinations were associated with older age groups, European origin and post-secondary school education and being male.

Conclusions: Given the small changes in sun protection over time, updated skin cancer campaigns are needed to encourage increased sun-protective behaviours and skin examinations among rural residents.

Implications for public health: Results suggest that updated health promotion campaigns targeted to rural areas are warranted.

Key words: rural, skin cancer, sun-protective behaviours, screening

Skin cancer remains a major public health issue in Australia, which is known as 'the skin cancer capital of the world'.[1] Australia has some of the highest incidence[2] and mortality rates of skin cancer internationally, due to high ultraviolet (UV) radiation levels from the sun, combined with a predominantly fair pigmented population.[3] The majority of skin cancers are considered to be preventable by avoiding sunburn and limiting exposure to UV radiation from the sun through the use of sunscreen, protective clothing and seeking shade.[4] Sun-protective behaviours are influenced by many psychological and socio-demographic factors.[5]

In the 1980s, the Australian state of Victoria launched the 'SunSmart' health promotion campaign which revolved around 'Slip (*on a shirt*), Slop (*on sunscreen*) and Slap (*on a hat*)'.[6] In 2007, elements of this campaign were extended nationally to include 'Slide (*on sunglasses*)' and 'Seek (*shade*)'.[6] These campaigns have contributed to improvements in sun-protective behaviours in Australia[7] and although patterns of sun-protective behaviours may have changed, the incidence of recent sunburn decreased between 2003 and 2011.[8]

In Australia, systematic, population-based screening for skin cancer has not been adopted due to insufficient evidence of benefit,[9] although regular skin self-examination and opportunistic screening of at-risk groups are encouraged.[1]

Studies to date have rarely assessed skin examination and sun-protection behaviour together, missing an opportunity to more fully understand skin cancer prevention behaviours and opportunities for intervention. However, a Western Australian study found a significant association between sun-protective behaviours and skin checks.[10]

Rural Australia carries a higher burden from skin cancer including melanoma than metropolitan Australia[11,12] and reduced access to dermatologists.[13] Key barriers to skin cancer detection reported by rural people include psychosocial factors, cited as stoicism, issue minimisation and reluctance to complain, and health service issues, including extended waiting times to see a doctor and

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concerns about privacy.[14] There has been little research focused on sun-protective behaviour and skin cancer screening in rural Australia[15] that could identify the needs of rural populations at risk of skin cancer. A better understanding of skin cancer screening and sun-protective behaviours in rural areas has been called for in the 'Improving Melanoma and Skin Cancer Awareness in regional and rural Australia' study (2019–2022) which aims to inform the development of resources targeted to rural populations.[16] The aim of this study is to assess whether the self-reported use of sun-protective measures and rates of skin examination have changed between 2001–2003 and 2016–2018 in the Goulburn Valley of rural Victoria among participants from randomly selected households.

Methods

Background to Crossroads-I and -II studies

Crossroads studies I and II[17,18] were undertaken in rural Victoria in a regional centre and surrounding smaller towns (six surrounding towns in Crossroads-I and three towns in Crossroads-II). This agricultural area of northern Victoria was originally selected due to its poor health outcomes and limited access to primary care. Since the initial study, the Goulburn Valley has changed from being a region of general practitioner workforce shortage to having similar numbers of general practitioners per population to the state average,[19] but the region is still experiencing high rates of chronic disease.[20] Surveys were developed to assess health, disease and access to care in the region across a range of health issues, including skin cancer prevention. Households were randomly selected from local government residential lists. Inclusion criteria for household participants included: ≥16 years of age and residence in the region for ≥6 months. Households were visited during and outside work hours six days a week to maximize participation and were visited up to twenty-one times before being deemed unresponsive. Surveys were conducted in the regional centre and smaller towns in every month of the year during Crossroads-I, and in almost every month in Crossroads-II (regional centre had no surveys in January and the smaller towns had no surveys in November/December). Ethical approval was granted by the Goulburn Valley Human Ethics Research Committee in 1999 (Crossroads-I GCH-3/99) and 2016 (Crossroads-II GVH20/16). Written consent was obtained from each participant.

During Crossroads-I (conducted 2001–2003), data were collected on paper and entered into an Access database, while during Crossroads-II (conducted 2016-2018), data were collected electronically via iPads (Apple, Cupertino, United States) using the REDCap platform (Research Electronic Data Capture, Vanderbilt University, United States). The same demographic and skin check questions were used in both studies. One question asked: '*In the last 2 years have you had a skin examination (for lesions/cancers)?*' Other questions related to skin cancer prevention: '*When you do go out in the sun, how often do you DELIBERATELY take protective measures?*' with the options of 'Always', 'Usually', 'Sometimes', 'Seldom', 'Never' or 'Don't go out in the sun'. Participants were then asked: '*Which protective measures did you take?*' specifically 'None', 'Sunscreen', 'Umbrella', 'Hat', 'Clothing', 'Sunglasses', 'Avoid Sun' or 'Other' with the options of 'yes' (coded as 1) or 'no' (coded as 0). A composite measure of sun-protective behaviours was calculated from the total score of sunscreen + umbrella + hat + clothing + sunglasses + avoid sun. Participants were asked to identify their ethnicity and these data were dichotomised into European and Non-European origin.

Statistical analysis

Data from Crossroads-I and II studies were imported into SPSS, version 26 (SPSS Inc, Chicago, United States) for further analysis. Analysis of data included Chi-square tests (categorical variables) and independent samples t-test (continuous variables). As it has been recognised that different populations exhibit differing sun-protective behaviours and use of skin cancer screening,[21] logistic regression analyses were used to assess potential associations between demographic variables (sex, age, location, education, ethnicity) and skin examinations or individual sun-protective behaviours, while controlling for differences observed between the two studies. The few gender non-binary participants were excluded from regression analysis. Missing data comprised <8% of the dataset and were excluded from regression analysis. Few (8.0%) participants recalled participating in both studies, although others may not have recalled their participation. The two databases were not linked and as numbers were small, no adjustment was made for participation in both studies.

Results

Overall, 5,328 participated in 2001–2003 (61% response rate) and 2,680 in 2016–2018 (61% response rate). Table 1 demonstrates that the Crossroads-II sample was older, had higher proportions of females, participants of non-European origin and participants with post-secondary school education than the Crossroads-I sample.

The percentage of participants reporting a skin check for skin cancers or lesions in the past two years had increased between the two studies (32.7% Crossroads-I vs. 40.8% Crossroads-II, $p<0.001$). The proportion of participants reporting that they did not go out in the sun, or 'always' or 'usually' used sun-protective measures when in the sun remained unchanged between Crossroads-I and II (66.0% vs. 65.5%, $p=0.660$). The mean number of sun-protective behaviours (composite measure of sun-protective measures) was also unchanged between Crossroads I and II (2.59 ± 1.26 vs. 2.59 ± 1.55, $p=0.867$). However, patterns of sun-protective measures differed between the two studies, with decreased use of umbrellas (from 7.9% to 3.1%, $p<0.001$), decreased use of protective clothing (from 38.7% to 32.0%, $p<0.001$) and increased avoidance of the sun when outdoors (from 18.8% to 34.3%, $p<0.001$).

Sun protection over time

The most commonly used sun-protective measures were sunscreen, wearing a hat or using sunglasses (Crossroads-I 60.5%, 69.9%, 63.7%, Crossroads-II 58.5%, 68.1%, 62.6%, respectively). Table 1 presents that, between the two studies, reported use of umbrellas and sun-protective clothing significantly decreased, whilst avoiding sun increased significantly.

Table 2 shows that after controlling for included independent variables in the logistic regression model, there was evidence of decreased use of umbrellas (OR 0.33 [95%CI 0.26, 0.43]), hats (OR 0.86 [95%CI 0.77, 0.96]) and protective clothing (OR 0.79 [95%CI 0.71, 0.88]), but also increased sun avoidance (OR 2.14 [95%CI 1.90, 2.40]) between the two studies. Participants of older age groups (50–59, 60–69, 70+) were less likely to report using sunscreen (OR 0.70, 0.53, 0.35, respectively), protective clothing (OR 0.81, 0.76, 0.64, respectively) and sunglasses (OR 0.77, 0.63, 0.38, respectively), but more likely to use umbrellas (OR 1.50, 1.80, 2.30, respectively) and to avoid the sun (OR 1.22,

1.11, 1.50, respectively) than participants aged <50 years. Females were more likely to use sunscreen (OR 1.80 [95%CI 1.63, 1.99]), umbrellas (OR 1.86 [95%CI 1.51, 2.29]), sunglasses (OR 1.55 [95%CI 1.40, 1.71]) and to avoid the sun (OR 2.08 [95%CI 1.85, 2.33]) than males, but less likely to wear a hat (OR 0.43 [95%CI 0.38, 0.48]). Participants of European origin were significantly more likely to use each of the sun-protective measures included (OR sunscreen 2.77 [95%CI 2.26, 3.40), hat 2.26 (1.84, 2.76), clothing 1.54 (1.25, 1.91), sunglasses 2.15 (1.75, 2.62), avoid sun 1.47 (1.15, 1.89]) and less likely to use no sun protection (OR 0.63 [95%CI 0.47, 0.86]) than participants of non-European origin. The same pattern was observed for participants with post-secondary school education than participants with secondary school education or less (OR sunscreen 1.68 [95%CI 1.52, 1.86), hat 1.47 [95%CI 1.32, 1.64), clothing 1.36 [95%CI 1.23, 1.51), sunglasses 1.47 [95%CI 1.32, 1.62), avoid sun 1.23 [95%CI 1.09, 1.38), no protection 0.70 [95%CI 0.59, 0.83]).

Skin checks

Table 3 presents a logistic regression analysis of independent variables associated with skin examinations (dependent variable) in the two studies. Older age groups (OR 1.93-3.07), being male (OR 1.22 [95%CI 1.10, 1.35]), European origin (OR 2.44 [95%CI 1.88, 3.17]), and having attained post-secondary school education (OR 1.25 [95%CI 1.13, 1.39]) were each associated with increased likelihood of reporting a skin examination in the previous two years. The likelihood of reporting a skin examination was higher in the more recent study (Crossroads-II, OR 1.19 [95%CI 1.07,

Table 1: General characteristics of the study populations of Crossroads-I and Crossroads-II, n(%) unless otherwise specified.

	Crossroads-I 2001–2003 n=5,328	Crossroads-II 2016–2018 n=2,680	*p*
Locality			
Regional centre	3,566 (66.9)	1,344 (50.1)	<0.001
Smaller towns	1,762 (33.1)	1,336 (49.9)	
Age (years) (mean ± SD)	45.95 ± 19.19	53.07 ± 20.02	<0.001
Age groups (years)			
<50	3,114 (59.2)	1,061 (40.1)	<0.001
50-59	812 (15.4)	415 (15.7)	
60-69	610 (11.6)	540 (20.4)	
≥70	722 (13.7)	633 (23.9)	
Sex			
Male	2,439 (45.9)	1,128 (42.3)	0.001
Female	2,879 (54.1)	1,539 (57.7)	
Other	0	2 (0.1)	
Ethnicity			
European origin	5,123 (96.2)	2402 (89.6)	<0.001
Non-European origin	205 (3.8)	278 (10.4)	
Education			
Secondary school or less	2,438 (51.2)	1,045 (39.1)	<0.001
Post-secondary school	2,321 (48.8)	1,625 (60.9)	
Skin checks			
No	3,160 (67.3)	1,580 (59.2)	<0.001
Yes	1,538 (32.7)	1,090 (40.8)	
Use of sun protection			
Always/usually	3,044 (63.4)	1,544 (61.1)	<0.001
Sometimes/seldom /never	1,630 (33.9)	873 (34.6)	
Don't go out in sun	123 (2.6)	112 (4.4)	
Number of sun-protective measures (mean ± SD)	2.59 ± 1.26	2.59 ± 1.55	0.867
Use of sun protective measures			
None	419 (8.7)	232 (8.7)	1.000
Sunscreen	2931 (60.5)	1,567 (58.5)	0.095
Umbrella	382 (7.9)	82 (3.1)	<0.001
Hat	3,389 (69.9)	1,825 (68.1)	0.106
Sun protective clothing	1,872 (38.7)	858 (32.0)	<0.001
Sunglasses	3,091 (63.7)	1,677 (62.6)	0.343
Avoid sun	908 (18.8)	919 (34.3)	<0.001

Table 2: Logistic regression of sun-protective measures and demographic and socioeconomic parameters (OR (95% CI).

	Reference	No Protection	Sunscreen	Umbrella	Hat	Clothing	Sunglasses	Avoided Sun
Town	1 (Smaller town)							
	Comparison: Regional centre	1.39 (1.17–1.65)*	0.99 (0.89–1.09)	1.86 (1.49–2.33)*	0.96 (0.86–1.06)	1.03 (0.93–1.14)	1.13 (1.02–1.25)*	0.95 (0.85–1.07)
Age Group (years)	1 (<50)							
	Comparison: (50-59)	1.04 (0.82–1.31)	0.70 (0.61–0.81)*	1.50 (1.14–1.98)*	1.21 (1.05–1.41)*	0.81 (0.70–0.93)*	0.77 (0.67–0.89)*	1.22 (1.04–1.43)*
	(60-69)	0.96 (0.74–1.23)	0.53 (0.46–0.61)*	1.80 (1.34–2.42)*	1.47 (1.25–1.73)*	0.76 (0.66–0.89)*	0.63 (0.55–0.73)*	1.11 (0.94–1.31)*
	(70+)	1.02 (0.80–1.29)	0.35 (0.31–0.41)*	2.30 (1.76–3.00)*	1.32 (1.14–1.54)*	0.64 (0.55–0.74)*	0.38 (0.33–0.43)*	1.50 (1.28–1.74)*
Sex	1 (Male)							
	Comparison: Female	1.10 (0.93–1.30)	1.80 (1.63–1.99)*	1.86 (1.51–2.29)*	0.43 (0.38–0.48)*	0.83 (0.76–0.92)*	1.55 (1.40–1.71)*	2.08 (1.85–2.33)*
Ethnicity	1 (Non-European origin)							
	Comparison: European origin	0.63 (0.47–0.86)*	2.77 (2.26–3.40)*	0.74 (0.49–1.14)	2.26 (1.84–2.76)*	1.54 (1.25–1.91)*	2.15 (1.75–2.62)*	1.47 (1.15–1.89)*
Secondary Education	1 (≤Secondary)							
	Comparison: (post-Secondary)	0.70 (0.59–0.83)*	1.68 (1.52–1.86)*	1.36 (1.11–1.67)*	1.47 (1.32–1.64)*	1.36 (1.23–1.51)*	1.47 (1.32–1.62)*	1.23 (1.09–1.38)*
Study period	1 (Crossroads-I)							
	Comparison: Crossroads-II	1.06 (0.88–1.27)	1.05 (0.94–1.17)	0.33 (0.26–0.43)*	0.86 (0.77–0.96)*	0.79 (0.71–0.88)*	1.09 (0.98–1.22)	2.14 (1.90–2.40)*

Note:
**p<0.05*

1.33]) than the previous study (Crossroads-I), as per table 3.

Finally, the mean number of sun-protective behaviours (composite measure) was significantly higher among participants who reported having had a skin check than participants who had not had a skin check (2.78 ±1.34 vs. 2.51 ± 1.36, $p<0.001$).

Discussion

This study found relatively small changes in sun-protective behaviours between the two studies conducted 15 years apart in rural Victoria, Australia. An increase in sun avoidance was apparent, but also a simultaneous decrease in the use of other sun-protective behaviours (use of hats, protective clothing and umbrellas). Results also showed an increase in reporting of recent skin checks. There was a significant association between an increased number of sun-protective measures and an increased likelihood of skin checks. Studies rarely include assessment of both skin checks and sun-protective behaviours, but in those that do, a similar association has been reported.[10,22] Regular skin self-examination has been reported to be more common in rural locations than in major cities.[23] In a recent study of sun safety attitudes and practices among farmers in rural New South Wales, 72.5% reported having examined themselves for skin cancer at least once in their lifetime.[24] However, as fewer than half of respondents in the Crossroads studies reported having had a skin examination in the previous two years, there remains room for improvement. Increasing access to skin cancer education and screening services could assist to increase rates of skin checks and awareness, perhaps by the targeted focus of at-risk groups in primary care, potentially using automated reminders within practice software, regular skin cancer clinic days or a rural specific public health campaign.

Our results suggest that many sun-protective behaviours could be improved and increased, particularly those rated as more protective than sunscreen (namely seeking shade and using protective clothing).[25] Significant associations between certain skin cancer-related behaviours (individual sun-protective measures and skin examinations) and demographic groups were observed, as has been reported previously. Sun-protective behaviours have been described as the outcome of sun protection motivation, which is influenced by an individual's perceived risk (perceived severity and vulnerability to skin cancer) and response likelihood (perceived efficacy of sun-protective measure and the associated 'costs').[26] In this way, older people may be more likely to avoid the sun because they perceive skin cancer to be a severe health concern (due to high prevalence among older age groups, or historically poor outcomes) or they perceive sunscreen as less efficacious (due to historically poorer sun-protective factors). Females may perceive wearing hats or protective clothing to be at the 'cost' of being fashionable, or that some degree of tanning is desirable.[27] People of European origin may use more sun-protective measures and undergo skin examinations because they perceive their personal risk of skin cancer to be high due to their skin colouring or tendency to sunburn. These findings would assist in informing future rural specific public health campaigns to target skin cancer screening and sun-protective behaviours.

Skin cancer prevention is an important issue for Australians and this study demonstrates the need for increased awareness and promotion of prevention behaviours and screening. There is a need for more research among rural populations, including motivation to undertake sun-protective behaviours, perceived risk of skin cancer and perceived efficacy and 'cost' of sun-protective behaviours and skin checks. Interventions that aim to increase sun-protective behaviour and skin cancer screening by informing individuals of their personal skin cancer risk in rural areas would be valuable. Public health campaigns that highlight the importance of skin cancer screening[28] and how to check your skin for unusual or changing moles may lead to increased sun-protective behaviours. Updated sun-protection campaigns, leveraging a social marketing approach, may be warranted to tailor messaging and mode of delivery according to the values and knowledge of specific market segments.[29] In this way, campaigns could be tailored to at-risk groups including males, older people, people in rural areas and those with outdoor occupations, in similar ways to those demonstrated in the recent message to address sun protection complacency among males: 'When you cover things they last longer. Same goes for you'.[30] Continued advocacy for increased public shade and for scheduling of outdoor activities, including sport, to times of lower UV indices[31] is important, particularly given climate change, and a preference toward outdoor recreation and dining during the COVID-19 pandemic.

Table 3: Logistic regression of skin checks and demographic parameters.

	Reference	Comparison	OR (95% CI)	*p*
Town	1 (smaller town)	Regional centre	1.001 (0.903–1.110)	0.985
Age Group (years)	1 (<50)	50–59	1.925 (1.67–2.218)	<0.001
		60–69	2.750 (2.375–3.185)	<0.001
		70+	3.066 (2.664–3.528)	<0.001
Gender	1 (Male)	Female	0.822 (0.743–0.909)	<0.001
Ethnicity	1 (Non-European)	European origin	2.438 (1.877–3.167)	<0.001
Secondary Education	1 (≤Secondary)	Post–Secondary	1.253 (1.129–1.392)	<0.001
Crossroads	1 (Crossroads-I)	Crossroads–II	1.192 (1.070–1.328)	0.001

Limitations

These results are based on self-reported data and are therefore subject to social desirability bias and recall bias. Dichotomised responses (for example, use of sunscreen Yes/No) are also likely to lead to a loss in the depth of understanding.[32] Data related to differences in behaviour between summer and winter, time of day, or during periods of extreme UV were not collected. There are mixed opinions about whether self-reported data overestimates sun-protective behaviours compared with observational data[33] or provides good concordance.[34] In future studies, more detailed survey questions may assist participants with recall, for example: '*In the past week, which of these sun-protective measures have you used?*'. In addition, it would be important to include questions about the number of sunburns experienced by participants, time spent outdoors during periods of high UV and skin type/sun sensitivity, for example, by using the Fitzpatrick scale.[35]

In conclusion, relatively small, but encouraging changes to sun-protective behaviours and skin examinations over a 15-year period in this rural Victorian setting were identified, although there is scope for improvement, particularly among at-risk groups such as males and people

with less educational attainment. Trends in sun-protective behaviour and skin cancer screening in rural areas can inform targeted public health campaigns to address a long-standing burden of skin cancer in rural areas. Further research into the barriers to optimal sun-protective behaviours and skin cancer screening experienced by rural residents is required to inform practical, context-specific solutions. However, this analysis suggests more needs to be done to improve sun-protective behaviours and skin cancer screening in this, and probably other, rural regions.

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Ethics approval

Ethical approval was granted by the Goulburn Valley Human Ethics Research Committee in 1999 (Crossroads-I GCH-3/99) and 2016 (Crossroads-II GVH20/16). Written consent was obtained from each participant.

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