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Abstract

Background/Objectives: Renal transplant recipients (RTRs) have high skin cancer incidence and mortality. In Australia RTRs receive extensive public education on skin cancer and many further education pre/post-transplant. Study objectives were to examine whether RTRs' sun protective behaviours are sufficiently rigorous compared with the general population.

Methods: (n=179) RTRs from two large Melbourne hospitals involving skin clinic teams in patient care were recruited to cross-sectional telephone interviews. Comparisons were made with residents (aged 25-69 years) surveyed using equivalent measures and methods in two adjacent summers (2006-07 n=904, 2010-11 n=942) in a regular national population monitoring study. Multivariate analyses of weekend behaviours were adjusted for related ambient temperature records.

Results: RTRs were more compliant with sun protection behaviours on the weekend prior to interview compared with residents surveyed. Specifically, for 2006-07 and 2010-11, the odds ratio and confidence intervals (CI 95%) were respectively: used sunscreen: 2.0 (1.1-3.8) and 2.8 (1.4-5.3); wore a long-sleeved top: 4.5 (2.4-8.5) and 3.6 (1.9-7.0) and spent less time outdoors (exponentiated regression coefficients: both 0.8 (0.6-0.97) and (0.7-1.1), respectively). RTRs sunburn prevalence (5%) appeared similar to residents (odds ratios c.f. 2006-07 and c.f. 2010-11 0.6 (95% CI, 0.2-1.6) and 0.7 (95% CI, 0.3-1.9)). Many RTRs (47%) had skin cancers treated; despite generally good sun protection behaviours.

Conclusion: The intensive education of RTRs may have contributed to their better sun protection. A few RTRs with excessive exposure to ultraviolet radiation warrant further prevention strategies. These findings may be particularly relevant to other RTR populations receiving education about sun protection.

Key words: compliance, organ transplant recipients, photoprotection, skin cancer**Introduction**

In Australia skin cancer is common among the broader population[1] as well among renal transplant patients (RTRs)[2,3], and public education campaigns and supportive public policy on skin cancer prevention have been implemented across decades.[1] Two leading treatment hospitals in Melbourne, Australia, have undertaken intensive skin cancer management protocols for RTRs including involvement of the dermatology departments, regular review and education pre- and post-transplant. We hypothesised that RTRs in these two hospitals would have relatively good awareness and knowledge of skin cancer. [1] This study aimed to examine whether RTRs from these hospitals had sufficiently rigorous sun protective behaviours, compared with the general population.

Material and Methods

During summer December 2008 to February 2009 RTRs from two Melbourne hospitals were surveyed about their sun-related attitudes, and their behaviours and sunburn on the weekend prior to the interview. Comparisons were made with samples of residents from across the state (Victoria) interviewed in summer 2006-07 and 2010-11 as part of the regular national sun protection surveys (NSPS). All three surveys used equivalent study methods, while different social research companies conducted the interviews using written protocols. The RTRs survey was adapted from the 2006-07 NSPS [4] with 10 transplant specific items appended.

RTRs were interviewed in cross-sectional surveys over a 12-week period. These interviews were conducted by telephone on the two evenings preceding the weekend or a Monday public holiday. Ethics committees' approvals were obtained from each hospital for the RTR survey, and Cancer Council Victoria for the NSPS. Climate data for Melbourne on the dates relating to the respondent's weekend activities were used in the analyses.

RTRs 18 years or older on the hospitals' transplant registers (n=422) were invited via a mail-out in November 2008 to participate in a telephone interview. To minimise

influencing their weekend sun protective behaviour the survey was described in terms of 'health behaviours'. Non-respondents received one follow-up telephone call. Of 422 RTRs invited to participate, 201 returned a consent form agreeing to participate, while 179 completed an interview (a response rate of 42%).

The majority of NSPS measures have been published.[5,6] These questions assess respondents' demographic characteristics; skin type; preference for a sun tan, other attitudes and beliefs; the respondent's sunburn ('any amount of reddening of the skin after being in the sun') incidence on the preceding weekend, and their sun exposure and protective behaviours specific to their main activity outdoors (>15 minutes) during peak UVR hours (11am - 3pm).

The questions developed specifically for the RTRs can be seen in the Supplementary Table and assessed renal transplantation, skin cancer history; and skin health information provided after transplantation.

RTRs' sun-protective behaviours and sunburn were the main outcomes of interest. Dichotomous variables described respondents' weekend behaviours (detailed responses to the questions on clothing cover were coded to indicate protection used - yes or no) and included use of: a hat, a wide-brimmed hat, clothing with at least three-quarter length sleeves, clothing with three-quarter length leg cover, sunscreen (sun-protection factor 15+), sunglasses and staying primarily under shade during their activity. These weekend variables were based on the respondent's reported behaviours on the Sunday prior to interview, with the exception of when the respondent was only outdoors on Saturday. The outcome variable for sunburn considered any sunburn reported by respondents on either weekend day. A body exposure index (BEI) score was calculated to describe the proportion of the respondent's body exposed according to the sun protective behaviours they used during their outdoor activity.[7] Time spent outdoors during peak UVR hours was analysed as a continuous variable.

Statistical analysis

Analyses described the prevalence of sun protective behaviours and sunburn incidence among RTRs using unweighted frequencies and means. Factors strongly associated with RTRs' sun protective behaviours were identified using multivariate analyses (logistic regression or multiple linear regression), with insufficient cases to model RTR's sunburn. Separate models compared RTRs' sun-related attitudes, behaviours and sunburn incidence with residents of comparable ages (25 to 69 years). Age, sex and skin type were included as independent explanatory variables in all models. Skin cancer treatment history was included

in the models predicting RTRs' behaviours. For the comparisons with residents in both 2006-07 and 2010-11 there were sufficient 'numbers of cases to variables'[8] to include relevant climate data in the models (the ambient 3pm temperature on the activity date for behavioural outcomes, additionally the mean UV Index levels 11am – 3pm for sunburn outcomes). Factors associated with RTRs' outdoor activities during peak UVR (>15 minutes) were examined by chi-square analyses. Some of the covariates used for these analyses required further reduction to support convergence of the multivariate models.

The Hosmer-Lemeshow test was used to assess model fit. Statistically significant relationships were determined by the 95% confidence intervals (CI) for each regression coefficient and corresponding Wald statistic p-value. Similarly, $p<0.05$ was considered significant for bivariate analyses. Population weights were not applied, but age and sex were adjusted for in the multivariate analyses. All statistical analyses used IBM SPSS Statistics 20.0 (Armonk, NY).

Results

RTRs' characteristics

179 RTRs aged 21 to 76 years were interviewed, with their characteristics described in Table 1. There were slightly more men surveyed. RTRs were a median of 9 years post-transplantation. A high proportion reported sunburn sensitive skin (skin type). Given RTRs age (mean 54 years, SD=11), 30% were retired, while 33% were in full-time and 16% in part-time employment. A total of 8% of RTRs worked in a job where they spent at least half of their time outdoors. The majority of RTRs were residents of greater metropolitan Melbourne (57%) or regional Victoria (38%).

Skin cancer advice and treatment history

Most RTRs (78%) had seen a health professional 'specifically for their skin' post transplantation. Of the 123 (69%) RTRs who had seen a health professional for their skin in the last 12 months 86% saw a dermatologist, 23% a transplant physician, nurse or surgeon, 19% a general practitioner and 7% other health professionals. Overall 59% of RTRs had seen a dermatologist in the last 12 months. Post-transplantation, RTRs received information about skin cancer either by verbal advice from a clinician (89%) and/or by written information or

pamphlets (74%), a lecture (29%), instructional videos (7%) or other means (7%). RTRs preference for receiving information about skin cancer post-transplantation comprised 25% instructional videos, 32% verbal advice from clinicians and 40% written information or pamphlets.

Forty-seven per cent of RTRs had a history of treatment for skin cancer, with a median of 4 skin cancers excised (range 1-500 as estimated by RTRs) and 15% excised prior to transplant.

RTRs sun-related attitudes and behaviours

Few RTRs reported harmful sun-related beliefs (Table 2) (e.g. liked to get a suntan, or agreed that a suntanned person *is* more healthy). However, the belief that a suntan looks healthy (i.e. attractive) was more common as was RTRs' belief their friends supported tanning. The majority of RTRs held a positive attitude towards sun protection, 74% agreed that "if I protect myself from the sun, I can avoid skin cancer".

Fifty-six per cent of RTRs were outdoors during peak UVR hours on the weekend prior to interview, for a median of 60 minutes (interquartile range=30 to 150 minutes). The majority of RTRs engaged in sun protection behaviours (wore a hat, sunscreen, sunglasses, and covering clothing) whilst outdoors (Table 2). The least common behaviours were wearing a wide-brimmed hat (39%) and staying under shade (33%). The mean BEI score of RTRs was 0.1 (SD=0.1) with observed scores ranging from 0 (all skin protected) to 0.6 (60% of the body exposed).

Demographic factors associated with RTRs' sun protection

Table 3a and Table 3b show there was limited evidence of differences in RTRs' sun protective behaviours by demographic characteristics when adjusting for skin cancer excision history and other covariates. The difference of note was that there was a lower odds of women outdoors during peak UVR hours (>15 minutes) compared with men.

Comparisons with the resident population's sun-related attitudes and behaviours

Generally RTRs reported less harmful sun-related beliefs when compared with residents of equivalent age, namely 25 to 69 years in 2006-07 and 2010-11 (Table 4). There was a lower odds of RTRs reporting they like to get a sun tan (RTRs c.f. 2006-07 residents: OR 0.3, 95% CI 0.2-0.6; RTRs c.f. 2010-11 residents: OR 0.5, 95% CI 0.3-0.7), and lower

odds they agreed close family think a suntan is a good thing (RTRs c.f. 2006-07 residents: OR 0.5, 95% CI 0.3-0.8; RTRs c.f. 2010-11 residents: OR 0.6, 95% CI 0.4-1.0). There were a few differences in RTRs' attitudes that were only evident compared with the general population in the earlier survey (2006-07). Although the majority of RTRs and residents agreed that if they protect themselves from the sun, they can avoid skin cancer, there was a lower odds of RTRs reporting this positive attitude towards prevention (RTRs c.f. 2006-07 residents OR 0.5, 95% CI 0.4-0.8). A substantial proportion of both residents' and RTRs' believed a tan *looked* healthy (i.e. was attractive), with no statistical difference in this belief between the groups. However, while few RTRs or residents believed a tan *is* healthy, the odds of RTRs agreeing a tan is healthy was lower compared with residents in 2006-07 (OR 0.5, 95% CI 0.3 – 1.0).

There were a number of statistically significant differences in RTRs' and residents' sun exposure and sun protection on summer weekends when adjusting for weather conditions and demographic covariates (Table 5a and 5b). RTRs spent significantly less time outdoors during peak UVR hours (RTRs c.f. 2006-07 residents EXP B (exponentiated regression coefficient)=0.8 , 95% CI 0.6- 0.97; RTRs c.f. 2010-11residents EXP B=0.8 , 95% CI 0.70-1.1). Compared with residents in 2006-07 and 2010-11, RTRs had a higher odds of using sunscreen (c.f. 2006-07 residents: OR 2.0, 95% CI 1.1-3.8; c.f. 2010-11 residents: OR 2.8 95% CI 1.4-5.3), and wearing at least three-quarter length clothing cover on their arms (c.f. 2006-07 residents: OR 4.5, 95% CI 2.4 – 8.5; 2010-11 residents: OR 3.6, 95% CI 1.9-7.0). RTRs also had a higher odds of wearing a hat compared with residents in 2010-11 (OR 2.7, 95% CI 1.3-5.6) and wearing at least three-quarter length clothing on their legs compared with residents in 2006-07 (OR 2.7, 95% CI 1.3-5.6). The mean proportion of unprotected skin (BEI scores) among RTRs was lower compared with residents (BEI 0.07 units lower c.f. 2006-07 residents: regression coefficient -0.1, S.E.= 0.020; and BEI 0.08 units lower for 2010-11 residents: regression coefficient -0.1, S.E.=0.018). In addition a bivariate analysis, not controlling for covariates, showed a statistically non-significant difference in the proportion of RTRs spent more than 15 minutes outdoors during peak UVR hours on summer weekends compared with residents (RTRs: 57%, 2006-07 residents: 66%, 2010-11 residents 66%; X^2=5.9, df=2, p=.054).

Sunburn incidence

Incidence of weekend sunburn among RTRs overall (21-79 years) was very low (6%). Somewhat limited by this low sunburn incidence, the multivariate models controlling for demographic and ambient UV index levels as covariates found no evidence of a significant difference in odds of sunburn among RTRs and residents aged 25-69 years. This result was similar for both the UV adjusted models including only respondents who were outdoors in the metropolitan area on the weekend (RTRs c.f. 2006-07 residents: OR 0.5, 95% CI 0.2-1.9; RTRs c.f. 2010-11 residents: OR 0.6, 95% CI 0.2-2.3), and for the models additionally considering respondents indoors on the weekend (RTRs c.f. 2006-07 residents: OR 0.6, 95% CI 0.2 – 1.6; RTRs c.f. 2010-11 residents: OR 0.7, 95% CI 0.3 – 1.9).

Discussion

Our results indicate the RTRs surveyed had relatively rigorous sun protective compliance when compared with residents. However, 6% of RTRs had less compliant sun protective behaviours which resulted in sunburn. Forty-seven per cent of RTRs had skin cancer excised (many multiple) post-transplantation, while 15% had prior skin cancer treatment reflecting the high incidence of this tumour in Australia. The high experience of skin cancer among RTRs may have promoted more rigorous sun protection compliance, but there was no statistical evidence that behaviours were associated with skin cancer history. Due to hospital policies on transplant care, we found most RTRs in our sample received advice from a dermatologist about their increased risk, most likely further promoting increased sun protection compliance. [9,10]

The high self-reported skin cancer incidence among RTRs in our sample may be subject to over-reporting of non-cancerous lesions, but is consistent with incidence reviews. [11, 12] For example, 10-year post-transplantation incidence of NMSC in high UV environments were 37% in Spain [13], and 45% in Queensland, Australia [14] and 52% confirmed by a dermatologist in routine checks.[3] Lower skin cancer incidence is observed among RTRs resident in low UVR environments [15] and countries with less susceptible skin types.[16]

There are few other studies of RTRs' sun protection behaviours in Australia.[17] The findings of high compliance of RTRs' sun protection behaviours compared with the general population are relatively robust, given identical measures and adjustment for weather conditions (i.e. temperatures) in our analyses minimised a major influence on behaviour.[5]

One other study in the U.S. using identical measures also found higher compliance with sunscreen use among RTRs compared with the broader population, while they did not find substantial differences in compliant attitudes or use of covering clothing.[18] The relative compliance between the two studies is limited by cultural and skin cancer awareness differences,[19] and also RTR sample differences in age and years' post-transplantation. Our study also measured behaviours at a recent specific date and time, rather than sun protection 'habits'. In other research transplant recipients' sun protection compliance has varied, with regular sunscreen use observed at 5%, [20] 63%, [21] and 77%, [10] and prior use universal (92%) [22]. Nonetheless, compliance has generally been considered to be less rigorous than needed, while education during care has shown benefits in two studies.[11, 22]

Our comparisons with the general population were limited by different survey timing, with a national skin cancer campaign broadcast in summers across the study periods. Therefore temporal changes in population behaviours above temperature differences were expected.[23] Nonetheless, comparisons with the general population in two adjacent summers to the RTR survey provides stronger evidence of a likely real difference in behaviours among RTRs. Moreover, analysis of trends for previous surveys of the Melbourne resident population using the same survey questions as the current study indicate that the higher compliance with clothing cover by RTRs is a much greater difference (three to four times the odds for wearing three-quarter length sleeves) than in any survey year in Melbourne since 1987 [6, 24, 25] and nationally since 2003 [5, 23]. There was less difference in compliance for sunscreen and hats among RTRs and residents (although still at least double the odds for sunscreen), consistent with more substantial improvements in use of sunscreen and hats over the earlier decade (1990s) among the general population. [6]

Albeit, our residents samples were not age-matched with RTRs, but among Australian adults 25 years or older there is less variation in sun protection with age than with younger adults [11]. However, our multivariate analyses adjusted for age-group (25-49 years vs. 50-69 years) a recommended approach to minimising bias. [26]

Selection bias may be present in our study population. To limit duress the invited RTRs received only one reminder to participate, resulting in 42% agreeing to participate. Reasons for non-participation may have influenced the representativeness of our findings on compliance and sunburn. It may mean lower sunburn prevalence if due to being unwell and indoors most of the time, while higher sunburn if they had less compliant sun protection

attitudes and behaviours than our respondents. However, this is unlikely given the recruitment letter did not cue about sun protection content. Demographic data on RTRs in the care of the study hospitals during 2009 (n=516) were available for comparison and suggest the study participants may have been slightly older (mean 54 years, SD=11 c.f. 51 years, SD=12) and had longer post-transplantation (mean 11, SD=8 c.f. 7, SD=6). Hence it is likely that these patients would have more skin cancers treated. Although a sizeable proportion of RTRs in two Melbourne hospitals were represented in the study, the findings may not be generalizable to all RTRs in Melbourne given other hospitals at the time of the study may not have had as intensive skin cancer management and education for their RTRs.

Due to immunosuppression, RTRs will need to achieve a high level of compliance with sun protection to avoid future skin cancer. The current research suggests as a minimum hospital policies should ensure RTRs are given education about preventing skin cancer and have regular clinical examinations. For those RTRs who are less compliant with sun protection, education alone appears insufficient, and research to identify barriers to compliance and measures to improve adherence are needed with this group. Nonetheless, given the RTRs in two hospitals with education on skin cancer and high compliance with sun protection recommendations still experienced a high incidence of skin cancer, in a high UV environment such as Australia, RTRs' level of sun protection compliance may still be inadequate. Further behavioural intervention is needed to determine if compliance can be further improved and/or other chemoprevention strategies implemented to reduce the burden of skin cancer outcomes for RTRs.

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Table 1: Sample characteristics of surveyed renal transplant patients aged 21-76 years

	Men (n=98)	**Women (n=81)**	**Overall (n=179)**
Age, yrs.			

	Men (n=98)	Women (n=81)	Overall (n=179)
21-49	32%	36%	34%
50-76	68%	64%	67%
Skin type[†]			
Not sensitive (tan only)	37%	20%	29%
Moderately sensitive (burn then tan)	44%	49%	47%
Highly sensitive (burn only)	19%	30%	24%
Outdoor work			
Yes, at least half the time	14%	1%	8%
No, very little or no time	40%	41%	40%
Retired	35%	30%	30%
Full-time study	1%	4%	2%
Home duties	10%	25%	19%
Transplanting hospital			
Hospital 1	48%	33%	42%
Hospital 2	52%	67%	59%
Years post-transplantation (mean (SD))	9.9 (7.5)	11.4 (9.0)	10.6 (8.2)
History of skin cancer excised[‡]	47%	47%	47%

Table 1(continued): Sample characteristics of surveyed renal transplant patients aged 21-76 years

	Men (n=98)	Women (n=81)	Overall (n=179)
Number of skin cancers excised[‡] ***(mean (SD))***	13.7 (25.3)	17.5 (80.5)	15.4 (56.9)
Saw a dermatologist for skin in past 12 months	63%	54%	59%

Note: Due to rounding some figures do not add to 100%.

†Excluded n=4 RTRs who could not say their skin reaction after 30 minutes of sun exposure at start of summer without skin protection, and n=5 reported 'nothing would happen'.

‡ RTRs estimated the number of skin cancers cut out (defined as including a melanoma, basal cell carcinoma or squamous cell carcinoma cut out). Respondents without a history of skin cancer did not report data.

Table 2: Prevalence of RTRs' sun-related attitudes and weekend sun protection behaviours

	Men (n=98)	**Women (n=81)**	**Overall (n=179)**
Sun-related attitudes			
'Like to get a suntan' (Yes)	12%	16%	14%
'A suntanned person is more healthy' (Agree)	10%	5%	8%
'A suntanned person looks more healthy' (Agree)	44%	49%	46%
'Close family think a suntan is a good thing' (Agree)	19%	19%	19%
'Friends think a suntan is a good thing' (Agree)	25%	36%	30%
'If I protect myself from the sun, I can avoid skin cancer' (Agree)	74%	74%	74%
Sun exposure during peak UVR hours (11am-3pm)			
Outdoors (>15 min) (Agree)	64%	47%	56%
Time outdoors (min) (Mean (SD))	191.3 (76)	92.8 (73)	98.1 (75)
Body exposure index † (Mean (SD))	0.1 (0.1)	0.1 (0.1)	0.1 (0.1)
Sunburnt on weekend (Yes)	6%	5%	6%

Table 2(continued): Prevalence of RTRs' sun-related attitudes and weekend sun protection behaviours

	Men (n=98)	**Women (n=81)**	**Overall (n=179)**
Sun protection used during peak UVR hours	n=63	n=38	n=101
Wore a hat (hat or cap)	73%	55%	66%
Wore a wide-brimmed hat	44%	29%	39%
Used SPF 15+ sunscreen	57%	61%	58%
Wore ¾ or long-sleeved top	48%	47%	52%
Wore ¾ or long leg cover	71%	76%	73%
Stayed mostly under shade	35%	29%	33%
Wore sunglasses	54%	66%	58%

Note: Due to rounding some figures do not add to 100%.

†The body exposure index (values 0 to 1) describes the proportion of the body without sun protection as indicated by RTRs reported behaviours while outdoors on Saturday or Sunday during11am-3pm.

Table 3a: Demographic factors associated with renal transplant recipients' use of sun-protective behaviours on summer weekends. (Categorical outcomes)

	Outdoors during peak UVR hours N=170 OR (95% CI)	**Hat or cap N=97 OR (95% CI)**	**Sunscreen N=97 OR (95% CI)**	**Long sleeves N=97 OR (95% CI)**	**Long leg cover N=97 OR (95% CI)**	**Used shade N=97 OR (95% CI)**	**Sunglasses N=97 OR (95% CI)**
Age, yrs.							
21-49 (Ref)	1	1	1	1	1	1	1
50-76	0.9 (0.4-1.8)	1.2 (0.5-3.2)	0.8 (0.3-2.0)	1.0 (0.4-2.4)	0.7 (0.2-1.9)	1.1 (0.4-2.2.8)	0.7 (0.3-1.9)
Sex							
Male (Ref)	1	1	1	1	1	1	1
Female	0.4 (0.2-0.8)[a]	0.4 (0.2-1.0)	1.0 (0.5-2.5)	1.1 (0.5-2.6)	1.2 (0.5-3.2)	0.7 (0.3-1.8)	1.5 (0.6-3.6)
Skin type							

Table 3a (continued): Demographic factors associated with renal transplant recipients' use of sun-protective behaviours on summer weekends.[†] (Categorical outcomes)

	Outdoors during peak UVR hours N=170	**Hat or cap N=97**	**Sunscreen N=97**	**Long sleeves N=97**	**Long leg cover N=97**	**Used shade N=97**	**Sunglasses N=97**

	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Highly or moderately sensitive (Ref)	1	1	1	1	1	1	1
Not sensitive	1.2 (0.6-2.5)	0.5 (0.2-1.4)	0.5 (0.2-1.0)	1.1 (0.5-2.6)	2.7 (0.9-8.1)	0.9 (0.4-2.4)	1.1 (0.5-2.7)
Skin cancer history							
No	1	1	1	1	1	1	1
Yes had skin cancer	0.6 (0.3-1.2)	2.0 (0.8-5.3)	1.6 (0.6-3.9)	2.2 (0.9-5.4)	1.0 (0.4-2.7)	0.4 (0.2-1.1)	1.6 (0.7-3.9)

Abbreviations: yrs.=years; Ref, referent group; OR=odds ratio; CI confidence interval; a p<.01

† Excluded n=4 could not say skin reaction after 30 minutes of sun exposure at start of summer without skin protection, and n=5 reported 'nothing would happen that were outdoors on the weekend'.

Table 3b: Demographic factors associated with renal transplant recipients' use of sun-protective behaviours on summer weekends.† (Continuous outcomes)

	Time ‡ N=99		Body Exposure Index§ N=97	
	(Exp)B	**95% CI**	**B**	**95% CI**
Age, yrs.				
21-49 (Ref)	1		0.1	
50-76	0.8	0.5-1.1	0.0	-0.0-0.1
Sex				
Male (Ref)	1		0.1	
Female	0.9	0.7-1.3	-0.0	-0.1-0.1
Skin type				
Highly or moderately sensitive (Ref)	1		0.1	
Not sensitive	1.2	0.8-1.7	0.0	-0.1-0.1
Skin cancer history				
No	1		0.1	
Yes had skin cancer	1.3	0.95-1.9	-0.0	-0.1-0.0

Abbreviations: yrs.=years; Ref, referent group; CI confidence interval; B=regression coefficient; EXP B=exponentiated regression coefficient

† Excluded n=4 could not say skin reaction after 30 minutes of sun exposure at start of summer without skin protection, and n=5 reported 'nothing would happen' that were outdoors on the weekend.

‡ Time spent outdoors (in minutes) was logged, therefore the coefficients were exponentiated and are interpreted as the adjusted ratio of means and compared with the referent group (Exp)B=1.

§The body exposure index (values 0 to 1) describes the proportion of the body without sun protection as indicated by RTRs reported behaviours while outdoors on summer weekends. N=101 respondents were included in the multiple linear regression model for this continuous outcome. The model regression coefficient was reported for each referent group.

Table 4: Prevalence of sun-related attitudes among renal transplant patients (RTRs) compared with residents. (Categorical outcomes)

	Residents 2006-07 25-69 yrs. (n=904) %	**RTRs 2008-09 25-69 yrs. (n=166) %**	**Residents 2010-11 25-69 yrs. (n=942) %**	**RTRs versus 2006-07 Vic residents† OR (95% CI)**	**RTRs versus 2010-11 Vic residents† OR (95% CI)**
Preference and attitudes towards sun tanning					
Yes 'Like to get a suntan'	36	15	30	0.3*** (0.2-0.5)	0.5** (0.3-0.7)
Agree 'A suntanned person looks more healthy'	52	45	49	0.7 (0.5-1.0)	0.8 (0.6-1.2)
Agree 'A suntanned person is more healthy'	12	7	10	0.5* (0.3-1.0)	0.7 (0.4-1.3)
Agree 'Close family think a suntan is a good thing'	26	16	24	0.5** (0.3-0.8)	0.6* (0.4-1.0)
Agree 'Friends think a suntan is a good thing'	37	31	36	0.9 (0.6-1.2)	0.9 (0.6-1.3)
Agree 'If I protect myself from the sun, I can avoid skin cancer'	83	74	82	0.6** (0.4-0.9)	0.7 (0.5-1.1)

Abbreviations: yrs.=years; OR=odds ratio; CI confidence interval; *p<0.05, **p<.01, ***p<.001

†Logistic regression analyses controlled for age, sex and skin type and excluded respondents who could not say their skin sensitivity or reported nothing would happen (n=55).

Table 5a : Prevalence of sun-protective behaviours and sunburn on summer weekends among renal transplant patients (RTRs) compared with residents. (Categorical outcomes)

	Residents 2006-07 25-69 yrs. (n=904) %	**RTRs 2008-09 25-69 yrs. (n=166) %**	**Residents 2010-11 25-69 yrs. (n=942) %**	**RTRs versus 2006-07 Residents OR (95% CI)**	**RTRs versus 2010-11 Residents OR (95% CI)**
Sun exposure					
Outdoors (>15 min) †	66	57	66	--	--
Sunburn on weekend (overall respondents) ‡	8	5	6	0.6 (0.2 – 1.6)	0.7 (0.3 – 1.9)
In Melbourne while doing outdoor activity	**N=459**	**N=49**	**N=504**		
Sunburn amongst respondents outdoors 11am-3pm on weekend §	11	6	8	0.5 (0.2 – 1.9)	0.6 (0.2 - 2.3)

Table 5a (continued): Prevalence of sun-protective behaviours and sunburn on summer weekends among renal transplant patients (RTRs) compared with residents. (Categorical outcomes)

	Residents 2006-07 25-69 yrs. (n=904) %	**RTRs 2008-09 25-69 yrs. (n=166) %**	**Residents 2010-11 25-69 yrs. (n=942) %**	**RTRs versus 2006-07 Residents OR (95% CI)**	**RTRs versus 2010-11 Residents OR (95% CI)**
Sun protection used *β*	**N=459**	**N=49**	**N=504**		
Wore a hat (hat or cap)	44	57	38	1.6 (0.7 – 3.4)	2.1* (1.0-4.3)
Wore a wide-brimmed hat	19	29	16	1.3 (0.6-3.3)	1.6 (0.7-3.7)
Used SPF 15+ sunscreen	38	53	33	2.0* (1.1 – 3.8)	2.8** (1.4-5.3)

Wore ¾ or long-sleeved top	20	53	25	4.5*** (2.4 – 8.5)	3.6*** (1.9-7.0)
Wore ¾ or long leg cover	57	78	64	2.7** (1.3 – 5.6)	1.9 (0.9-4.1)
Stayed mostly under shade	28	37	30	1.8 (0.9 – 3.3)	1.7 (0.9-3.3)
Wore sunglasses	54	59	58	1.4 (0.7 – 2.6)	1.1 (0.6-2.1)

Abbreviations : yrs.=years; *p<0.05, **p<.01, ***p<.001

† It was not possible to adjust for weather conditions for respondents indoors on both weekend days, and analysis of whether or not respondents were outdoors on just one weekend day might be influenced by past or intended exposure on the other day. Therefore a simple bivariate analysis tested group differences in the proportion of respondents outdoors on Saturday or Sunday with results reported in the text.

‡ The logistic regression models of sunburn among respondents overall include both respondents who were residents of Melbourne who were indoors, as well as any respondents who were outdoors in metropolitan Melbourne between 11am and 3pm on the previous Saturday or Sunday. Respondents sunburnt on Saturday or Sunday at times outside the peak UVR period were excluded. Due to a limited number of sunburnt cases to predict in the multivariate model, the only demographic covariates adjusted for were age and skin type. The mean UV Index levels (11am-3pm in Melbourne), as recorded by the Australian Radiation and Nuclear Safety Agency for the relevant day of respondents' outdoor activities, were included as an additional covariate. There was evidence of a poor fit of the data for the 2010-11 model (Hosmer Lemeshow test p<.001) and results should be interpreted with caution. Exclusion of further covariates from this model was not appropriate.

§ The logistic regression models of sunburn among respondents outdoors include only respondents who were outdoors in metropolitan Melbourne between 11am and 3pm on the previous Saturday or Sunday. Respondents sunburnt on Saturday or Sunday at times outside the peak UVR period were excluded. Due to a limited number of sunburnt cases to predict in the multivariate model, the only demographic covariates adjusted for were age and skin type. The mean UV Index levels (11am-3pm in Melbourne), as recorded by the Australian Radiation and Nuclear Safety Agency for the relevant day of respondents' outdoor activities, were included as an additional covariate.

β The logistic regression models of weekend sun protection behaviour include respondents who were outdoors in metropolitan Melbourne between 11am and 3pm on the previous Saturday or Sunday (excluding n=55 who could not say their skin sensitivity or reported nothing would happen).The multivariate analyses adjusted for age, sex, skin type, and temperature (degrees Celsius), with wind speed (kilometres per hour) for hats. The weather data used were the Bureau of Meteorology's records at 3pm in Melbourne on dates related to respondent's outdoor activity.

Table 5b: Prevalence of sun-protective behaviours on summer weekends among renal transplant patients (RTRs) compared with residents. (Continuous outcomes)

	Residents 2006-07	**RTRs 2008-09**	**Residents 2010-11**	**RTRs versus**	**RTRs versus**

	25-69 yrs. Mean (SD)	25-69 yrs. Mean (SD)	25-69 yrs. Mean (SD)	2006-07 Residents† Regression coefficient (95% CI)	2010-11 Residents† Regression coefficient (95% CI)
In Melbourne while doing outdoor activity	**N=459**	**N=49**	**N=504**		
Time outdoors, min	102 (69)	88 (69)	103 (71)	(Exp)B‡=0.8* (0.6 - 0.97)	(Exp)B‡=0.8 (0.7 – 1.1)
Body exposure index	0.2 (0.1)	0.1 (0.1)	0.2 (0.1)	B= -0.1*** (-0.1 - -0.04)	B= -0.1*** (-0.1 - -0.04)

Abbreviations: yrs.=years; EXP B=exponentiated regression coefficient; B, regression coefficient; *p<0.05, **p<.01, ***p<.001

†. These multiple linear regression analyses controlled for age, sex, skin type, and temperature (degrees Celsius). The temperature data used were the Bureau of Meteorology's records at 3pm in Melbourne on dates related to respondent's outdoor activity. Respondents who were outdoors in metropolitan Melbourne between 11am and 3pm on the previous Saturday or Sunday were included in these analyses. Respondents who could not say their skin sensitivity or reported nothing would happen (n=55) were excluded from these analyses.

‡. The time outdoors variable was log transformed (*ln*) to meet multiple linear regression assumptions. The exponentiated regression coefficients (Exp)B can be interpreted as the adjusted ratio of means compared with residents the reference group. The exponentiated model constants estimate the geometric means of time outdoors for the model of RTRs with 2006-07 as 83.0 minutes and the model of RTRs with 2010-11 as 85.2 minutes. These analyses excluded n=17 missing/can't say time outside.

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