Tanning behaviors and determinants of solarium use among indoor office workers in Queensland, Australia

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Abstract

Using cross-sectional survey data from Brisbane, Australia, this study identifies prevalence and factors associated with indoor tanning in office workers. Over 12-months, 72/2867 (2.5%) survey participants used solaria. Twenty-eight sunbed users (39%) tanned outdoors and used spray-tans and 42 (58%) reported burns after indoor tanning. Results from regression modelling suggests the strongest predictors of sunbed use were beliefs that tanning was safer indoors than outdoors (OR 6.1, 95%CI: 2.6-14.0) and engaging in outdoor tanning (OR 4.1, 95%CI: 1.8-9.0). We recommend that health authorities promote health gains by reducing ultraviolet radiation exposure or substituting indoor tanning with a spray-on tan.

Introduction

Exposure to artificial ultraviolet radiation (UVR) emitted by indoor tanning devices has been linked in the long-term to an increased risk of developing malignant melanoma (Cust et al., 2010; Han et al., 2006; International Agency for Cancer Research, 2007; Lazovich et al., 2010), squamous and basal cell skin cancers (Han et al., 2006) and, to a lesser extent, eye disease (Vajdic et al., 2004) and photoageing (Lavker et al., 1995). A meta-analysis by the International Agency for Research on Cancer (IARC) found an overall relative risk of melanoma from ever-use of sunbeds of 1.15 (95% confidence interval (CI) 1.00-1.31), and for first exposure to sunbeds before the age of 35 of 1.75 (95%CI 1.35-2.26) (International Agency for Cancer Research, 2007). Subsequently, the IARC recommended that young adults be discouraged from using indoor tanning devices and that access to minors be restricted. Furthermore, in 2008 the IARC upgraded the carcinogenic risk of tanning devices to Group 1 (carcinogenic to humans)(International Agency for Research on Cancer, 2010). More immediate health effects from indoor tanning devices include acute skin damage from erythema, blistering and rashes, especially if the use of pharmaceuticals (e.g., antidepressants, antibiotics, psoralens) or cosmetics has increased the skin's photosensitivity(WHO, 2003).

Many studies have aimed to understand the characteristics of those engaging in indoor tanning, although most describe solarium use among adolescents, the predominant users of solaria. A review of 13 studies of sunbed use among adolescent populations (ages 11-19 years) found that sunbed use was associated with being female, having fair complexion, smoking and other substance use, frequent outdoor tanning, beliefs that a tan looks healthier and more attractive than pale skin, having parental permission to visit solaria, having parents/friends that use sunbeds and not engaging in sun protection behaviors (Lazovich et al., 2004). A study involving 7200 French adults found similar characteristics associated with sunbed use including being female, being aged 35-39 years, having fair skin, using sunscreen (but not other skin protection) and having positive

attitudes towards tanning (Ezzedine et al., 2007). A lack of knowledge about the risks of sunbed use and skin cancer development may also be factor in sunbed use (Boynton and Oxlad, 2011).

Following the mounting evidence that children are engaging in artificial UVR exposure and the potentially deleterious health effects, a number European countries (France, Belgium, Scotland, Germany, Spain, Portugal) made solarium use illegal for minors, and the Brazilian government has imposed a complete ban on all cosmetic tanning devices (Sinclair, 2010). In 2007, there was intensive media coverage about a young 26-year old Australian woman who was dying of melanoma and who attributed her cancer to her sunbed usage. A government enquiry into the deleterious effects of solaria use followed and a major social marketing campaign, 'Dying to get a tan,' was launched in the state of Victoria. Over the next two years all Australian states enforced laws which ban persons aged under 18 years and/or with skin type I (skin that burns easily and does not tan) from using solaria (Gies et al., 2010b). ~~In Australia, which has the highest reported rates of skin cancer in the world,~~ Around the world, there is keen interest in whether the recent legislative controls are effectively restricting access to solaria by vulnerable populations at risk of developing skin cancer.

Indoor workers may be at a particularly high risk of melanoma and possibly basal cell carcinoma of the skin due to the intermittent nature of their ultraviolet exposure and a relatively more susceptible phenotype than is often observed in outdoor workers (Green et al., 1996). The use of solaria may further exacerbate this risk, so understanding the characteristics of those who use sunbeds may lead to ways to mitigate the risk of skin cancer. In this context, the objective of this study was to observe the prevalence and immediate health effects of indoor tanning in a population of indoor urban workers in March 2009, following Queensland legislative controls in October 2008, and to compare the characteristics, behavior, knowledge and beliefs of the office workers who were sunbed users with those who did not use sunbeds.

Methods

The methods of this study have been reported previously (Vu et al., 2010). Briefly, the study sample was 4,709 office workers employed by a single large commercial firm located in Brisbane, Queensland, Australia. Ethics approval was obtained from the Queensland Institute of Medical Research Human Research Ethics Committee. All staff members of the firm were eligible and participation was voluntary. In March 2009, staff were sent an email from internal management asking them to complete an online survey posted on the firm's secure internal website.

The online survey was developed by the research team and covered the general themes of sun protection behaviors and beliefs, the use of solaria, doctor's visits for skin checks and/or treatment, and knowledge of vitamin D. The items specifically used in this analysis included socio-demographic factors (sex, age, education), skin cancer risk factors (hair color, skin color, skin sensitivity to UV exposure), use of indoor tanning devices, adverse effects of indoor tanning, and sun protection knowledge and attitudes. The survey included items that had been previously validated and routinely used in national, regional and community surveys on sun protection behaviors and attitudes (Dobbinson et al., 2005; Green et al., 1994; Lawler et al., 2006; Viertel Centre for Research in Cancer Control, 2005). It was pre-tested by the research team, and a computer programmer built in a number of quality checks and skips to ensure only logical responses were allowed. Reminder emails were sent to non-respondents after two weeks. Respondents were rewarded for completing the survey by being entered into a draw to win a restaurant dinner for two. Survey data were provided in a de-identified format to the researchers.

We defined sunbed users as those who had used any indoor tanning device in the past 12-months. Each sunbed user was matched to two non-users by 10-year age groups, sex and skin color (n=144 non-users). We used bivariate analyses to identify factors that were independently associated with sunbed use. Next, conditional multivariate logistic regression models were built using a selected group of explanatory variables chosen to represent the major categories of candidate determinants

for solaria use (i.e., socio-demographic factors, health behaviors, phenotypes, tanning and sun protection behaviors/beliefs, awareness and knowledge). Explanatory variables were selected if they were significant at the bivariate level or were established predictors of sunbed use in the literature (Ezzedine et al., 2007; Lazovich et al., 2004). Where several variables were significant at the bivariate level within the same major category, we added or removed variables from the same category until the highest predictive power of the model was achieved, indicated by the adjusted R^2. Results were expressed as adjusted odds ratios (AOR) with 95% CIs. We used STATA/SE® 11.0 software the analyses.

Results

A total of 2,867 people (61% of 4,709 eligible) completed the questionnaire with full information on socio-demographic characteristics. Of these, 60% were female, 61% were aged less than 40, 57% fair skin color, 30% medium and 14% olive/brown skin color. A total of 72 (2.5%) were identified as having used an indoor tanning device for cosmetic purposes in the 12 months prior to the survey date. Of the sunbed users, almost two-thirds were female, 60% were aged less than 40 years, 40% had fair skin and around half had medium skin color (Table 1). Seven sunbed users (10%) had high skin sensitivity; skin that burns but does not tan afterwards. During the past year, 32 users (44%) used a sunbed once or twice, 22 (31%) for concentrated bursts (that is, many times over a month or two months) and 8 (11%) used a tanning device more than twice a week. Most users used a tanning device at a solarium (64%) or a gym (25%). Tanning sessions most commonly lasted 5-10 minutes (71%) with 3% lasting between 15 and 30 minutes. Forty-two indoor tanners (58%) reported having been burnt after indoor tanning and a small proportion also developed blisters (3%) or a rash (7%). Over the past year, 33 solarium users (46%) indicated they had swapped to using a spray-on tan and of these, 23/33 (70%) reported using a spray-on tan. Twenty-eight sunbed users (39%) had also tanned outdoors and used spray-on tan during the past 12 months while 16 (22%) tanned outdoors but did not use spray-on tans.

After matching for age, sex and skin color, sunbed users and non-users were similar with respect to private health insurance, propensity to burn, and the number of days they worked (Table 1). Sunbed users were more likely to have red or fair hair color, to be current smokers and to drink alcohol weekly (although these associations were not statistically significant). A higher proportion of sunbed users than non-sunbed users had secondary schooling rather than tertiary training as the level of highest education attained (p=0.051). Sunbed users were twice as likely to tan outdoors in the past year (p<0.001) and a third more likely to use spray-on tan than non-users (p=0.009) (table 2). Those who used sunbeds were significantly less likely to wear hats or use sunscreen in both summer and winter (Table 2). Considering a tan to look healthy or attractive (p<0.001), having friends with positive attitudes towards tanning, and believing that solaria are safer than the sun (or not being sure) (p<0.001) were all positively associated with sunbed use (Table 2). The proportion of participants who had received skin checks by doctors, who had an understanding that sun protection will avoid the risk of skin cancer and that solar UVR causes photoaging was similar between the two groups.

In adjusted conditional logistic regression modelling, the strongest predictor of sunbed use was considering indoor tanning to be safer than outdoor tanning (or being unsure) (AOR 6.1; 95% CI 2.6-14.0), followed by having engaged in outdoor tanning (AOR .0; 95% CI 1.8-9.0), using spray-on tan in the past year (AOR 2.8; 95% CI 1.2-6.3) and the belief that a suntanned person looks healthier (AOR 2.3; 95% CI 1.1-5.0) (Table 3). The intention to wear sunscreen when outdoors in winter (AOR 0.2; 95% CI 0.1-0.9) was indicative of a person not likely to engage in indoor tanning.

Discussion

Our study reports on the prevalence and determinants of solarium use at a time when legislation of the Queensland solarium industry was changing. After matching for the universally known characteristics of sunbed users (younger age, female, fair skin), the strongest determinants of solarium use were the belief that indoor tanning was safer than sun tanning, engaging in outdoor

tanning, using spray-on tanning during the past year, and believing that tanned skin looks healthier than pale skin. Despite active campaigns from numerous health authorities encouraging sun protective behaviors and warning about the dangers of UVR, we found that tanning for cosmetic purposes by sunbathing, solaria or by spray-on lotions remains strongly desirable among some young adults and a small proportion engage in all three forms of tanning over a given period

The prevalence of sunbed use in our study population (2.5%) falls into the range of that reported from earlier surveys involving different Australian populations (0.9-3%)(Gordon et al., 2008). While the prevalence of sunbed use in study participants aged less than 40 (3.6%) is similar to that reported in Queensland residents of the same age prior to the Queensland solaria legislation (Viertel Centre for Research in Cancer Control, 2005) (2.4%), we have limited ability to comment about trends in solarium use due to different socio-demographic characteristics, including region of residence, in the two study populations. Furthermore, any changes in prevalence of sunbed use among adolescents, who are more affected by the legislation, remain unknown.

Despite having similar knowledge about the risks of skin cancer and photoaging associated with exposure to solar ultraviolet radiation, sunbed users were also more likely to engage in outdoor tanning and less likely to use sun protective measures than those who did not use sunbeds. In interpreting this finding, it may be helpful to consider a behavioural model, the Protection Motivation Theory (PMT). PMT contains two broad components; (1) the appraisal of threat (e.g. dangers of skin cancer, premature ageing) which provides the motivation to carry out protective or adaptive behaviours (e.g. refraining from solarium use). And (2) adequate self-efficacy and the ability to make an internal cost-benefit assessment (Floyd et al., 2000). It would seem that for the majority of participants in our study, skin protection knowledge, attitudes and intentions appears to have influenced their success in executing the choices to refrain from tanning. However, for others, either the appraisal of threat is unsuccessful or the motivational or enabling factors are absent. For example, a host of additional internal and external factors may interfere such as the false

perception of the safety of solaria, having friends or parents that use solaria and encourage its use, or the assessment that the benefit of looking tanned outweighs the risks of skin damage. Our data suggest that it is this focus on appearance that is most strongly driving the use of sunbeds. Thus interventions that highlight the negative consequences of tanning on appearance (for example wrinkling and sunspots) rather than on health risks may be effective for reducing the frequency of sunbed use (Mahler et al., 2003). Similarly, survey results from 390 young adults found that health (vs appearance) focused messages and gain (vs loss) framed messages had the greatest impact on intentions to use sunscreen in participants with high body consciousness (Hevey et al., 2010).

A study of women aged 15-50 found that despite the growth in the spray-on tans in recent years participants were reluctant to reduce UV exposure in favour of sunless tanning products (Paul et al., 2011). Conversely, ~~R~~roughly half of indoor tanners in our study said they had switched to using spray-on tan in the past 12 months. This may suggest a positive outcome from regulation of the industry in Australia, or it could reflect easier access to spray-on tanning, or increased awareness of the risks of tanning due to social marketing campaigns such as “The Dark Side of Tanning.” Only 10% of users indicated they had very sensitive skin and almost half of users reported only using a solarium once or twice in the past year. Balanced against these positive observations, almost a third of the users in our study stated using sunbeds for concentrated bursts. This is consistent with the way that Australian solarium businesses market their services through the use of 10-visit concessions, and also with the observed behavior in European countries, where indoor tanning devices are used at the beginning of summer or before holidaying at beach destinations, where outdoor tanning is a primary objective (Ezzedine et al., 2007). Although the majority of indoor tanners used a tanning device at a solarium there is evidence that even these dedicated tanning centres have little or no knowledge of the intensity of UVR emissions from their sunbeds, which is likely to lead to overexposure (Gies et al., 2010a). Unsurprisingly, over half of indoor tanners have been burnt after using a sunbed and a small proportion also received blisters or rashes.

The findings from this study are subject to some limitations. Firstly, the survey was carried out six months after legislation was enacted but we asked about sunbed use over a 12 month period. It is therefore possible that changes following legislation were obscured. The small sample of sunbed users has prevented further in-depth analysis of the determinants and any interaction effects. There was substantial negative press in late 2007 surrounding a young Australian woman dying of melanoma and claiming her sunbed use was the cause (Sinclair and Makin, 2008). This may have resulted in a degree of selection bias due to sunbed users being less willing to participate than those who did not use sunbeds. Finally, the population sample is limited to metropolitan indoor office workers. Although the size of the company and the relatively high response rate suggest that this sample should be broadly representative of other urban office workers, a group particularly susceptible to melanoma, it will not be representative of the general population.

Subject to the above caveats, we have shown a snapshot of the prevalence of solarium use in an urban working population and described characteristics of solarium users around the time of significant negative popular press and after regulations became enforceable in October 2008, both designed to discourage solarium use. For the majority of participants, it appears that broader sun protection knowledge has led to limited tanning behavior. Although it may be still too soon for the full effects of legislation to be realized, our results suggest that there remains a relatively small group of young working adults who are resistant to the educational messages about sun and sunbed exposure. Increasing knowledge about the risks of indoor tanning may lead to reduced use of solaria, but it is likely that alternative methods will need to be explored to change the behavior of those adults for whom the desirability of a tan appears to outweigh concerns about the longer-term risks. Based on these findings, we recommend that health authorities promote the health gains possible by reducing UVR exposure or substituting UVR tanning with a spray-on tan.

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Table 1 General and phenotypic features of non-users (n=144) and sunbed users (n=72)

	Non-users N (%)	Sunbed users N (%)	$\chi^{2\text{-test}}$ (P)
Sex			
Male	54 (37.5)	27 (37.5)	
Female	90 (62.5)	45 (62.5)	Matched
Age			
Less than 20 years	8 (5.6)	4 (5.6)	
20-29 years	78 (54.2)	39 (54.2)	
30-39 years	40 (27.8)	20 (27.8)	
40-49 years	14 (9.7)	7 (9.7)	
50-59 years	4 (2.8)	2 (2.8)	Matched
Skin color before tanning			
Fair	56 (38.9)	28 (38.9)	
Medium	66 (45.8)	33 (45.8)	
Olive/brown	22 (15.3)	11 (15.3)	Matched
Hair color			
Red	3 (2.1)	4 (5.6)	
Fair or blond (or white)	15 (10.4)	13 (18.1)	
Light brown	57 (39.6)	26 (36.1)	
Dark brown	46 (31.9)	29 (40.3)	
Black	23 (16.0)	0 (0.0)	0.071
30min strong sun, summer, no protection			
Burn then not tan afterwards	28 (19.4)	7 (9.7)	
Burn then tan	73 (50.7)	49 (68.1)	
Tan slightly without burning	31 (21.5)	10 (13.9)	
Tan a lot without burning	12 (8.3)	6 (8.3)	0.089
Ever smoked cigarettes, cigars, pipes			
Current smoker	22 (15.3)	18 (25.0)	
Never smoked	81 (56.3)	32 (44.4)	
Ex-smoker	41 (28.5)	22 (30.6)	0.123
Drink alcohol			
At least once a day	15 (10.4)	2 (2.8)	
At least once a week	67 (46.5)	47 (65.3)	
At least once a month	27 (18.8)	14 (19.4)	
Less than once a month	22 (15.3)	7 (9.7)	
Used to but have stop	6 (4.2)	1 (1.4)	
Life-long non-drinker	7 (4.9)	1 (1.4)	0.552
Private health insurance			
No	45 (31.3)	28 (38.9)	
Yes, hospital only	6 (4.2)	4 (5.6)	

Yes, extras only	14 (9.7)	5 (6.9)	
	Non-users N (%)	Sunbed users N (%)	$\chi^{2\text{-test}}$ (P)
Yes, hospital and extras	78 (54.2)	35 (48.6)	
Yes, other	1 (0.7)	0 (0.0)	0.226
Highest education completed			
Senior High School or less	51 (35.4)	39 (54.2)	
Tertiary	93 (64.6)	33 (45.8)	0.051
Average number of days work each week			
Less than 5	10 (6.9)	4 (5.6)	
5 or more	134 (93.1)	68 (94.4)	0.696

Table 2 Sun protection behaviors and knowledge among sunbed users (n=72) and non-users (n=144)

	Non-users N (%)	Sunbed users N (%)	$\chi^{2\text{-test}}$ (P)
Outdoor tanning in past year			
Yes	42 (29.2)	44 (61.1)	
No	102 (70.8)	28 (38.9)	<0.001
Used spray-on-tan in past year			
Yes	38 (26.4)	35 (48.6)	
No	106 (73.6)	37 (51.4)	0.009
Broad-brimmed, legion or bucket hat in summer			
Never	67 (46.5)	52 (72.2)	
Sometimes or always	77 (53.5)	20 (27.8)	<0.001
Broad-brimmed, legion or bucket hat in winter			
Never	86 (59.7)	63 (87.5)	
Sometimes or always	58 (40.3)	9 (12.5)	<0.001
How often sunscreen outdoors in summer			
Never or sometimes	52 (36.1)	46 (63.9)	
Usually or always	92 (63.9)	26 (36.1)	<0.001
How often sunscreen outdoors in winter			
Never or sometimes	112 (77.8)	69 (95.8)	
Usually or always	32 (22.2)	2 (4.2)	0.001
Intend to use sunscreen when next outdoors or next week			
Disagree or unsure	42 (29.2)	37 (51.4)	
Agree	102 (70.8)	35 (48.6)	0.001
Solarium is safer than sun			
Disagree	124 (86.1)	37 (51.4)	
Agree or Unsure	20 (13.9)	35 (48.6)	<0.001
A suntanned person looks more healthy			
Disagree or unsure	81 (56.3)	17 (23.6)	
Agree	63 (43.8)	55 (76.4)	<0.001
A suntanned person looks more attractive			
Disagree or unsure	78 (54.2)	17 (23.6)	
Agree	66 (45.8)	55 (84.7)	<0.001
Most of my friends think it is good to have a suntan			
Disagree or unsure	74 (51.4)	21 (29.2)	
Agree	70 (48.6)	51 (70.8)	0.002
Regular skin protection can avoid my risk of skin cancer			
Strongly disagree	2 (1.4)	2 (2.8)	
Disagree	12 (8.3)	9 (12.5)	
Unsure	9 (6.3)	4 (5.6)	
Agree	62 (43.1)	31 (43.1)	

Strongly Agree	59 (41.0)	26 (36.1)	0.794
	Non-users	Sunbed users	$\chi^{2\text{-test}}$ (P)
	N (%)	N (%)	
Regular sun protection puts me risk of lack of Vitamin D			
Strongly disagree	27 (18.8)	18 (25.0)	
Disagree	65 (45.1)	29 (40.3)	
Unsure	38 (26.4)	15 (20.8)	
Agree	13 (9.0)	7 (9.7)	
Strongly agree	1 (0.7)	3 (4.2)	0.036
Times burnt in past 12 months			
Never	17 (11.8)	6 (8.3)	
Once	56 (38.9)	20 (27.8)	
2-5 times	64 (44.4)	41 (56.9)	
6+ times	7 (4.9)	5 (6.9)	0.112
Exposure to sun causes skin ageing			
Strongly disagree	2 (1.4)	1 (1.4)	
Disagree	1 (0.7)	1 (1.4)	
Unsure	5 (3.5)	7 (9.7)	
Agree	52 (36.1)	27 (37.5)	
Strongly Agree	83 (57.6)	35 (48.6)	0.132
Skin checked by doctor in past 12 months			
Yes	30 (20.8)	25 (34.7)	
No	114 (79.2)	47 (65.3)	0.536

Table 3 Results of conditional multivariate logistic regression analysis assessing associations with sunbed use (n=216)[1]

Determinants	n	AOR[2]	95% CI	P-value
Solarium is safer than sun				
Disagree	161	1.0		
Agree or Unsure	55	6.1	(2.6-14.0)	<0.001
Tanned outdoors in past year				
No	130	1.0		
Yes	86	4.0	(1.8-.0)	0.001
Used spray-on-tan in past year				
No	143	1.0		
Yes	73	2.8	(1.2-6.3)	0.012
A suntanned person looks more healthy				
Disagree or unsure	98	1.0		
Agree	118	2.3	(1.1-5.0)	0.029
Frequency of wearing sunscreen outdoors in winter				
Never or sometimes	181	1.0		
Usually or always	35	0.2	(0.1-0.9)	0.036
Highest education completed[3]				
Senior High School or less	90	1.0		
Tertiary	126	0.5	(0.2-1.0)	0.045
Current smoker[3]				
No	76	1.0		
Yes	40	0.8	(0.4-1.8)	0.612

1. pseudo R^2 = 0.358, P<0.0000, LR chi2= 80.95
2. AOR = adjusted odds ratio
3. Although smoking and educational attainment variables were not significant at the bivariate level, these were included in the model due to the positive link to sunbed use here and in the broader literature.