



Sunless tanning product use as related to UV protective behaviors among young adults



Desire K. Christensen¹, Leslie K. Dennis^{1,2*}, Charles F. Lynch¹, Elaine M. Smith¹, Linda G. Snetselaar¹

¹Department of Epidemiology, College of Public Health, University of Iowa, Iowa City, USA.

²Division of Epidemiology and Biostatistics, Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, USA.

***Corresponding Author:** Leslie K. Dennis, Division of Epidemiology and Biostatistics, Mel and Enid Zuckerman College of Public Health, University of Arizona, 1295 N Martin Ave, PO Box 245211, Tucson, AZ 85724, USA. Tel: (520) 626-6408; E-mail: ldennis@email.arizona.edu

Abstract

Introduction: Sunless tanning products are a safe alternative to ultraviolet radiation for individuals seeking tanned skin. If used to replace ultraviolet (UV) tanning, these products have the potential to decrease UV exposure and thus skin cancer. Sun protective behaviors were characterized in a population reporting high importance of tanned skin.

Methods: Young adults (N=163) completed a self-administered questionnaire examining tanning attitudes, behaviors and beliefs along with lifetime use of tanning beds and sunless tanning products.

Results: Among students surveyed, 34% reported ever using sunless tanning products. Ever users were more likely to be female (OR=7.5), have fair skin (OR=1.4), have used tanning beds greater than 50 times (OR=2.5), used a larger amount of sunscreen (1.9) and have reapplied sunscreen when outside on a sunny day (OR=1.8). Ever users of sunless tanning products who stated they preferred them because they are safer were also more likely to use a larger amount of sunscreen (OR=2.1), reapply sunscreen on a sunny day (OR=2.8) and try to avoid midday sun on a sunny day (OR=2.1). However, other sun protection behaviors including increased frequency of sunscreen use, sitting in the shade or wearing hat were not more likely to be adopted by these participants.

Conclusions: Prevention efforts should target females with frequent tanning exposure via both sunbathing and tanning bed use to increase their use of sunless tanning products in combination with sunscreen use and reapplication.

Keywords: Adults; Sunless tanning products; Tanning beds; Ultraviolet radiation; College students; Tanning behavior; Skin sensitivity

Introduction

Skin cancer is the most common cancer in the United States^[1]. It is estimated that non-melanoma cancer cases make up twice the number of cases of all other cancers combined with an estimated 3.5 million cases diagnosed annually^[2]. While the rates of many cancers are on the decline, skin cancer has been rising within the United States and many parts of the world^[1,3].

Ultraviolet radiation (UVR) is considered the most important risk factor for the development of skin cancer^[4]. Sunless tanning products (creams, sprays and spray on tans) are promoted as a safe method to darken the appearance of skin. Sunless tanning products can be used instead of UVR to generate a tanned appearance, but some evidence suggests users may increase their UVR exposure with the use of these products^[5,6]. Information on the characteristics and behaviors of sunless tanning product users is limited.

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This information is important for understanding the use of sunless tanning products.

Few studies have reported findings on sunless tanning product use in populations engaged in frequent tanning behaviors that include sunbathing and use of tanning beds. This study used available information from a cross-sectional survey to characterize differences between users and non-users of sunless tanning products in a population of young adults with a high rate of tanning bed use and sun-seeking behaviors.

Methods

Participants

University students in the Midwest were recruited from randomly selected sororities and fraternities



with 10 or more members and asked to complete a self-administered questionnaire. Survey information was collected on 165 participants. Two students were excluded prior to analysis due to random responses or low risk for skin cancer reducing analyses to 163 participants. The details of the study are described elsewhere^[7]. The project received Human Subjects review and approval by the University of Iowa's Institutional Review Board. Two participants did not respond to the question used to assess preference for sunless tanning products because they are safer, accounting for the reduction to 161 participants for those analyses.

Measures

The survey assessed tanning attitudes, behaviors and beliefs providing information on sun habits, tanning bed use, sun sensitivity and sunless tanning product use. Participants who responded 'yes' to the question 'have you ever used self-tanning creams in order to get a tan?' were classified as ever users. Ever users of sunless tanning products who responded 'I prefer to use sunless tanning creams because I think using tanning creams is safer than lying in the sun or under a tanning lamp' were classified as having a preference for sunless tanning products because they are safer. Lifetime use of sunless tanning product was examined using three categories (none, 1 to 5 times, and greater than 6 times) based on the distribution of responders. Sun sensitivity was measured as tendency to burn (severe and painful, moderate, mild or no sunburn), ability to tan (deeply, moderately, mildly or no tan) and untanned skin color (fair, medium or dark). Responses with similar meanings were grouped (e.g., for responses to importance of tanning very and somewhat important were combined) and dichotomized based on frequency distribution cell sizes and the relationship under examination.

Statistical analysis

Frequency distributions were computed across all response categories to compare ever users of sunless tanning products versus never users, and those who prefer sunless tanning products because they are safer than other methods of tanning versus those who do not prefer them.

Logistic regression (PROC SURVEYLOGISTIC) was used to calculate weighted ORs using cluster analysis in both univariate and multivariate models. Cluster analysis was conducted to control for immeasurable factors that aggregate by sorority or fraternity house since members of Greek houses are selected based on unaccounted for factors that could act as confounders.

Effect modification was examined by gender but none was seen. Crude ORs are reported for host factors including age, sex and measure of sun sensitivity since host factors often lead to behaviors and beliefs. Since host factors of sun sensitivity (tendency to burn, inability to tan, and untanned skin color) are in the causal pathway of sunless tanning product use, they were not evaluated as potential confounders. Confounding by gender, age, tanning bed use, importance of tanning and reapplication of sunscreen was examined. Tanning bed use, importance of tanning, amount of sunscreen and reapplication of sunscreen were associated with the outcomes of interest, however, tanning bed use was the only confounder and was adjusted for in multivariate models.

Results

The age range of participants was 18 to 23 years with a median age of 20 years (Table 1). Most participants were female (72%), white (98%) and freshman or sophomores (78%) as were most users of sunless tanning creams. All participants who reported preferring sunless tanning products because they are safer than tanning beds or sunbathing were white females.

Table 1: Demographic characteristics among 163 sorority and fraternity students in the Midwest

Characteristics		Sunless Tanning Products		
		Never Users (N=108) N (%)	Ever users ^a (N=55) N (%)	Used because Safer ^b (N=26) N (%)
Gender	Females	65 (60.2)	52 (94.6)	26 (100)
	Males	43 (39.8)	3 (5.4)	0 (0)
Race	White	161 (98.1)	55 (100)	26 (100)
	Hispanic	2 (1.9)	0 (0.00)	0 (0.0)
Education	Freshman	34 (31.4)	13 (24.1)	4 (15.4)
	Sophomore	49 (45.4)	31 (57.4)	16 (61.5)
	Junior	10 (9.3)	6 (11.1)	5 (19.2)
	Senior+	15 (13.9)	4 (7.4)	1 (3.8)
Age	Mean	19.7	19.6	19.8
	Median	20	19	20.0
	Std	1.13	0.94	0.87
	Range	18-23	18-22	19-22

N is the number of responders; Columns do not always sum to the same total due to missing data.

^aResponded 'yes' to the question 'have you ever used self-tanning creams in order to get a tan?'

^bEver users of sunless tanning products who responded 'I prefer to use sunless tanning creams because I think using tanning creams is safer than lying in the sun or under a tanning lamp'

Ever users of sunless tanning products were more likely to be female, have fair skin, and have used tanning beds greater than 50 times (Table 2). Ever users were also more likely to view tanning as important but this association diminished after adjusting for tanning bed use. Frequency of sunscreen use did not differ between ever and never users of sunless tanning products. However, users were significantly more likely to apply larger amounts of sunscreen, reapply sunscreen when outside on a sunny day and try to avoid midday sun on sunny days (Table 2). Sunless tanning product users did not differ from non-users in trying to sit in the shade or wearing a hat on sunny days. Those who preferred sunless tanning products because they are safer were also significantly more likely to apply larger amounts of sunscreen and reapply sunscreen when outside on a sunny day (Table 3).

Table 2: Characteristics of ever users relative to never users of sunless tanning creams among 163 sorority and fraternity students in the Midwest

	Ever Users (N=55) ^a	Never Users (N=108) ^a	OR ^b (95% CI)	Adjusted OR ^c (95% CI)
Gender				
Male	3	43	1.0 ref	NA ^d
Female	52	65	7.5 (2.4, 23.4)	
Age				
18-19	29	46	1.0 ref	NA ^d
20	16	39	0.6 (0.4, 1.1)	
21-23	9	20	0.9 (0.4, 2.0)	
Year of College				
Freshman-Sophomore	44	83	1.0 ref	NA ^d
Junior+	10	25	0.9 (0.4, 1.7)	
Tendency to burn^e				
Never burns	16	39	1.0 ref	NA ^d
Burner	39	69	1.2 (0.7, 2.2)	
Inability to tan				
Deep-moderate tan	47	95	1.0 ref	NA ^d
Mild or no tan	8	13	1.3 (0.7, 2.5)	
Untanned Skin Color				
Medium	24	54	1.0 ref	NA ^d
Fair	31	54	1.4 (1.1, 1.8)	
Tanning bed use				
0-50 times	23	72	1.0 ref	NA
>50 times	32	36	2.5 (1.6, 4.0)	
Importance of tanning				
Not important	6	20	1.0 ref	1.0 ref
Very-Somewhat important	48	88	1.5 (1.0, 2.4)	1.2 (0.8, 1.8)
Sunscreen Use				
Never	9	17	1.0 ref	1.0 ref
Sometimes	36	78	0.8 (0.4, 1.9)	0.9 (0.4-2.1)
Always	10	13	1.5 (0.6-4.1)	1.6 (0.6-4.8)
Amount of sunscreen used				
Dime/ Nickel	15	44	1.0 ref	1.0 ref
Quarter/ Golfball+	38	58	1.7 (1.1-2.5)	1.9 (1.2-3.1)
Reapplication of sunscreen				
Rarely ^f	45	96	1.0 ref	1.0 ref
Every 15-60 minutes	9	12	1.4 (0.8-2.3)	1.8 (1.1-3.0)
On a sunny day I ...				
... try to avoid midday sun				
Disagree	44	90	1.0 ref	1.0 ref
Agree/Neutral	11	17	1.7 (0.8-3.6)	2.1 (1.0-4.5)
... try to sit in the shade				
Disagree	43	72	1.0 ref	1.0 ref
Agree/Neutral	12	34	0.7 (0.4-1.5)	1.1 (0.5-2.1)
... wear a hat when outdoors				
Disagree	43	74	1.0 ref	1.0 ref
Agree/Neutral	12	33	0.6 (0.3-1.3)	0.7 (0.4-1.6)

CI= confidence intervals; NA=not applicable; OR=odds ratios; ref=reference
^a Columns do not always sum to the same total due to missing data
^b Crude ORs weighted based on cluster analysis accounting for Greek house .

^c ORs adjusted for tanning bed use based on cluster analyses .

^d Host factors are not adjusted for tanning bed use

^e After first sun exposure in the summer, skin gets a mild, moderate or severe sunburn, or burn then tan compared to no sunburns

^f Never or every 2-3 hours

Table 3: Characteristics of those who prefer sunless tanning creams because they are safer relative to who do not prefer them among 161 sorority and fraternity students in the Midwest^a

	Prefer sunless tanning products because they are safer than other tanning (N=26) ^a	Do Not Prefer (N=135) ^a	OR ^b (95% CI)	Adjusted OR ^c (95% CI)
Gender				
Male	0	46	NC ^d	NA ^e
Female	26	89		
Age				
18-19	11	63	1.0 ref	NA
20	9	46	1.0 (0.5, 2.1)	
21-23	5	23	1.4 (0.6, 3.5)	
Year of College				
Freshman-Sophomore	20	106	1.0 ref	NA
Junior+	6	28	1.3 (0.6, 3.1)	
Tendency to burn^f				
Never burns	9	46	1.0 ref	NA
Burner	17	89	0.8 (0.4, 1.9)	
Inability to tan				
Deep-moderate Tan	25	117	1.0 ref	NA
Mild or no tan	1	18	0.2 (0.0, 1.4)	
Untanned Skin Color				
Medium	10	68	1.0 ref	NA
Fair	16	67	1.4 (0.7, 2.9)	
Tanning bed use				
0-50 times	12	82	1.0 ref	NA
>50 times	14	53	1.9 (0.6, 6.0)	
Importance of tanning				
Not Important	3	23	1.0 ref	1.0 ref
Very, Somewhat	23	111	1.5 (0.3, 8.2)	1.2 (0.3, 5.3)
Sunscreen Use				
Never	6	20	1.0 ref	1.0 ref
Sometimes	14	99	0.4 (0.1-1.1)	0.4 (0.2-1.2)
Always	6	16	1.3 (0.4-4.1)	1.3 (0.4-4.4)
Amount of sunscreen used				
Dime/ Nickel	6	52	1.0 ref	1.0 ref
Quarter/ Golfball+	19	76	2.0 (0.9-4.3)	2.1 (1.1, 4.2)
Reapplication of sunscreen				
Rarely	19	121	1.0 ref	1.0 ref
Every 15-60 minutes	6	14	2.3 (0.7-7.3)	2.8 (1.1, 6.8)
On a sunny day I ...				
... try to avoid midday sun				
Disagree	21	113	1.0 ref	1.0 ref

Agree/Neutral	5	21	1.5 (0.3-7.9)	1.9 (0.4-9.3)
...try to sit in the shade				
Disagree	22	93	1.0 ref	1.0 ref
Agree/Neutral	4	40	0.5 (0.1-2.2)	0.7 (0.2-3.1)
...try to sit in the shade				
Disagree	20	95	1.0 ref	1.0 ref
Agree/Neutral	6	39	0.7 (0.2-3.3)	0.9 (0.2-3.7)

CI=confidence intervals; NA=not applicable; OR=odds ratios; ref=reference
^aTwo participants did not respond to preference for sunless tanning products because they are safer, thus N=161.
^bWeighted OR based on cluster analysis accounting for Greek house.
^cWeighted OR adjusted for tanning bed use based on cluster analyses.
^dNot calculable
^eHost factors are not adjusted for tanning bed use.
^fAfter first sun exposure in the summer, skin gets a mild, moderate, or severe sunburn or burn then tan compared to no sunburns.

When sunless tanning product use was examined in categories of use, associations remained. More frequent use of sunless tanning products was seen in those who reported using these products because they feel better with a tan and among those using a tanning bed 50+ times (Table 4). However, a higher frequency of sunless tanning product use was also observed in those who reported using these products because they wanted to visit tanning salons or sunbathe less often. Reporting a preference for sunless tanning products because they are safer than other tanning methods was also associated with more frequent use of these products.

Table 4: Frequency of sunless tanning product use among 163 sorority and fraternity students in the Midwest^a

Characteristics	Sunless tanning product use			
	None	1-5 times	6+ times	p-value ^b
Use sunless tanning products to ... feel better with a tan				
Yes	0	5	19	
No	106	19	12	<0.0001
Lifetime Tanning bed use				
None	24	1	0	0.0017
1-50 times	47	13	9	
50+ times	35	10	22	
Use sunless tanning products to ... reduce tanning salons or sunbathing				
Yes	0	3	14	<0.0001
No	106	21	17	
Prefer sunless tanning products because they are ... safer than tanning salons or sunbathing				
Yes	0	5	21	<0.0001
No	106	18	9	

^aColumns do not always sum to the same total due to missing data.
^bP-values for a chi square test.

Discussion

Sunless tanning product users in this population exhibited an important sun protection behavior by being more likely to apply larger amounts of sunscreen, reapply sunscreen on a sunny day in the summer and avoiding midday sun on sunny days. Sunless tanning product users stated use so “they didn’t need to go to tanning salons or sunbath as often”. However, these students did

not try to sit in the shade or wear hats on sunny days that could protect them more from UVR exposure. While some still used tanning beds and/or sunbathed, these cross-sectional data do not tell us if participants decreased these behaviors with their use of sunless tanning products from prior behavior.

Other studies support our findings about who uses sunless tanning products. Brooks et al^[5] reported that sunless tanning users were more likely to be female and those users and potential users of sunless tanning products were more likely to have used tanning beds than non-users or never intended users. Cokkinides et al^[6] also reported that use of sunless tanning products was associated with a higher frequency of indoor tanning but not with use of sunscreen. Sunless tanning product users are reported as likely to view a tanned appearance as desirable^[8]. Other studies have suggested that sunless tanners relative to non-tanners may use sunscreen to avoid sunburns but practice other sun protection behaviors less frequently to achieve further tanning through UVR exposure^[9-13]. Having fair skin may lead students to try sunless tanning products as an addition to other tanning methods.

In contrast to our findings, Sheehan and Leshner^[14] reported that sunless tanning was associated with a decrease in tanning bed use. Their cross-sectional study surveyed individuals ranging in age from 14 to 58 years at indoor tanning salons in Georgia. The difference in findings could be attributed to population demographics such as age and regional differences likely due to the importance of tanning among 18 to 23 year olds. However, it may indirectly suggest that sunless tanning product users who do so to reduce their tanning bed use may then decrease their tanning bed use after college. Sunless tanning product users in a cross-sectional study at Emory University also reported decreased frequency of tanning in the sun or in tanning beds because of product use^[15], demonstrating possible protective effects of sunless tanning product use. However, a study including 15-50 year old females in Australia reported reluctance to reduce UV exposure in favor of using sunless tanning products^[16]. Additional research is needed to see if sunless tanning product use can lead to reduced tanning bed use and overall UV exposure.

Few studies have examined sunless tanning product users who report a preference for these products because they are safer. Students who reported a preference for these products because they are safer than tanning beds or sunbathing accounted for 47% of our ever users, and they were more likely to reapply and use larger amounts of sunscreen when outside on a sunny day in the summer. A cross-sectional survey by Stryker et al^[10] that compared to exclusive sunless tanners (users of sunless tanning products who do not tan indoors) to non-tanners (neither users of sunless tanning products or indoor tanning) found that exclusive sunless tanners were more likely to use sunscreen but were less likely to seek shade. Compared to exclusive indoor tanners, exclusive sunless tanners were more likely to practice sun protection behaviors. In our population, only one ever user of sunless tanning products did not use tanning beds. Although there was only one exclusive sunless tanners in our population, those who preferred these products because they are safer exhibited some of the same behaviors as the exclusive sunless tanners reported by Stryker et al^[10].

Sunless tanning creams have been marketed as a safe alternative for those who want to tan. A potential reported risk is that their use may affect the accuracy of dermoscopy screening

for pigmented lesions or melanoma^[17]. Thus it is suggested that physicians ask about sunless tanning product use when performing dermoscopy for melanoma screening. Contact dermatitis and damage to the stratum corneum was seen among three hairless dogs with daily application for 21 days of ethanol mixed with 5% dihydroxyacetone (DHA), the active ingredient in sunless tanning products^[18]. In contrast, application of 20% DHA in hairless mice delayed time to tumor development with moderate UVR exposure, suggesting superficial skin color may offer some protection from UVR. Thus, it is not known if the use of sunless tanning products in humans will reduce UVR exposure or protection from UVR^[19]. More specifically, there has been concern that users of these products may have increased UVR exposure. Most sunless tanning products do not contain sun protection factor (SPF). By creating a tanned appearance, sunless tanning products could result in a false sense of protection from UVR leading to a reduction in UVR prevention behaviors and an increase in UVR exposure.

The use of sunless tanning creams as an alternative to UVR is not well established. Russo et al^[20] characterized sunless tanning product use in female college students who engaged in indoor tanning. Sunless tanning product users were more knowledgeable about harmful effects of tanning, although use of these products was not different among the three subtypes of indoor tanners: occasional, seasonal and regular. To see if promoting behavioral substitutes for sun exposure may reduce sun exposure, a cluster randomized trial was designed to reducing sunbathing frequency^[21]. The trial compared a beach-based intervention that promotes sunless tanning as a substitute for sunbathing to a control group that only received a questionnaire^[21]. The intervention used motivational messages to use sunless tanning products as an alternative to UVR tanning^[8], and also included sun damage imaging and sun safety recommendations among female beach visitors in eastern Massachusetts^[21]. Compared to controls, the intervention group reported significant decreases in sunbathing and increases in sunless tanning relative to the control group up to one year after the intervention^[10]. Thus, promoting sunless tanning as an alternative to UV tanning had at least a short-term effect in reducing UV exposure.

There are a few limitations in our study. It is a cross-sectional survey and cannot assess changes in behavior over time. As with all surveys, it is susceptible to misclassification bias where subjects will not be completely accurate in recalling exposures. However, most items had high test-retest reliability when a subset of subjects were resurveyed using the same questions a month later. The survey did not ask about frequency of sunbathing or changes in sunbathing behavior, but instead focused more on tanning bed and sunless tanning cream use. The survey was based on sorority and fraternity students and findings may not be generalizable to other populations. Despite its limitations, this study provides important information on the characteristics and behaviors of sunless tanning cream users in a population where tanning is important.

Tanning behaviors of young adults are important to consider because of the potential for increased risk of UVR damage and skin cancer in these populations. More prevention efforts are needed to reduce sunbathing and tanning bed use in young adults. Sunless tanning products serve as an alternative tanning method. Sunless tanning products have the potential to appeal to individuals who view tanning as important. Prevention inter-

ventions could focus on fair-skinned females to combine sunless tanning product use with increased use and reapplication of sunscreen. The most frequent users of sunless tanning products in our study were also frequent tanning bed users. Prevention efforts should target tanning bed users in addition to sunbathers when promoting the safety of sunless tanning products in combination with sunscreen use. Frequent users of sunless tanning products may be more inclined to reduce tanning salon visits or sunbathing based on responses of study participants.

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