

# UV light abuse and high-risk tanning behavior among undergraduate college students

Solmaz P. Poorsattar, BS,<sup>a,b</sup> and Robin L. Hornung, MD, MPH<sup>b,c</sup>  
*San Francisco, California, and Seattle, Washington*

**Background:** The failure of skin cancer prevention efforts to alter tanning behaviors may be a result of the addictive nature of UV light.

**Objective:** This study attempts to determine the prevalence of UV light substance-related disorder (SRD).

**Methods:** A survey was administered to undergraduate college students. The cut down, annoyed, guilty, eye-opener questionnaire was used to determine existence of SRD.

**Results:** Of 385 respondents, 12% scored positively on the cut down, annoyed, guilty, eye-opener indicating SRD. Women, indoor tanners, students with tanning family and friends, and frequent tanners were significantly more likely than their peers to score positively.

**Limitations:** The small size is a limitation of this study as results may not be generalizable to larger populations. There also may be self-report bias.

**Conclusions:** A significant proportion of college students demonstrate evidence of SRD with respect to UV light. (J Am Acad Dermatol 2007;56:375-9.)

In the United States, the incidence of malignant melanoma increases each year.<sup>1,2</sup> Research exploring the cause of this epidemic consistently links excessive UV light exposure early in life to skin cancer later in life<sup>3-7</sup> and finds young skin to be particularly sensitive to UV radiation.<sup>8-11</sup> Therefore, decreasing UV light exposure during childhood and adolescence is a central objective of skin cancer primary prevention efforts.

Most prevention programs focus on educational interventions meant to increase parents' and children's knowledge of the dangers of UV light over-exposure. Unfortunately, studies have shown that

increased knowledge, especially among adolescents and young adults, often fails to alter tanning behavior and attitudes.<sup>12-19</sup>

It has been suggested anecdotally for years that one reason tanning is so popular is that UV light is addictive.<sup>20-22</sup> Many adolescents who regularly tan indoors self-report difficulty in quitting tanning.<sup>23</sup> Experiments have also shown that UV light is a reinforcing stimulus that causes endorphin release.<sup>24-26</sup> A recent study among beachgoers in Texas confirmed that many sunbathers met criteria for having substance-related disorder (SRD) with respect to UV light.<sup>27</sup> The potential addictive nature of UV light tanning might explain why educational prevention efforts have been largely unsuccessful.

To better understand the UV light tanning behaviors of adolescents and young adults and their reasons for persistently tanning, this study examines a population of college-age tanners, their tanning attitudes and behaviors, and prevalence of SRD with regard to UV light.

## METHODS

After permission was obtained from our human subjects review committee, students attending a convenience sample of undergraduate classes in all colleges of the University of Washington in Seattle during December 2005 and January 2006 were asked

From the University of California, San Francisco, School of Medicine<sup>a</sup>; Children's Hospital and Regional Medical Center, Seattle<sup>b</sup>; and Division of Dermatology, Department of Pediatrics, University of Washington School of Medicine.<sup>c</sup>

Funding sources: None.

Conflicts of interest: None identified.

Accepted for publication August 26, 2006.

Reprint requests: Robin L. Hornung, MD, MPH, Division of Dermatology, M2-7, Children's Hospital and Regional Medical Center, 4800 Sandpoint Way NE, Seattle, WA 98105. E-mail: [robin.hornung@seattlechildrens.org](mailto:robin.hornung@seattlechildrens.org).

Published online January 31, 2007.

0190-9622/\$32.00

© 2007 by the American Academy of Dermatology, Inc.

doi:10.1016/j.jaad.2006.08.064

**Table I.** Characteristics, self-reported tanning practices, and cut down, annoyed, guilty, eye-opener questionnaire responses of all survey respondents and those scoring positively on the questionnaire

Student characteristics	All survey respondents (n = 375)	Respondents scoring positively on the CAGE (n = 46)
Female*	65%	87%
Skin phototype		
I	19%	11%
II	32%	33%
III	28%	35%
IV	16%	20%
V	4%	2%
Age, y		
17 and 18	22%	11%
19 and 20	49%	63%
21-24	22%	22%
25-30	7%	4%
Family history of skin cancer*		
Yes	20%	35%
No	65%	50%
Unknown	15%	15%
Personal history of skin cancer	0%	0%
Tanning practices		
History of blistering sunburn*	48%	63%
Outdoor tanners*	70%	100%
Indoor tanners*	33%	76%
Family members tan*	41%	59%
Friends tan*	83%	100%
History of tanning bed burn*	15%	57%
	All UV light tanners (n = 256)	Respondents scoring positively on the CAGE (n = 46)
<b>Modified CAGE questions</b>		
Have you ever felt you ought to cut down on your tanning?	21%	87%
Have people annoyed you by criticizing your tanning?	9%	41%
Have you ever felt bad or guilty about your tanning?	20%	87%
Have you ever thought about tanning first thing in the morning?	13%	28%

CAGE, Cut down, annoyed, guilty, eye-opener.

\* $P < .05$  when comparing all survey respondents with those scoring positively on the CAGE.

to complete a 1-page anonymous multiple-choice questionnaire. Information collected included demographic data, personal tanning practices, and tanning practices of family and friends.

Four questions in the survey also comprised a modified cut down, annoyed, guilty, eye-opener (CAGE) questionnaire tool, which was used to determine whether participants showed symptoms of SRD with regard to UV light (see Table I for modified CAGE questions). The CAGE questionnaire is a thoroughly tested tool most often used to identify SRD with regard to alcohol.<sup>28</sup> Other researchers have suggested that screening for other substances can effectively be incorporated into the CAGE format by simply including references to them in the questions.<sup>29</sup> The CAGE questionnaire is reported to be 60% to 90% sensitive for detecting SRDs when two or more questions are positive and 40% to 60% specific for excluding substance abuse.<sup>30</sup>

Descriptive frequencies were used to describe survey responses. The percentages reported for each item are based on the valid number of responses to the item. Students who reported experiencing two or more of the CAGE criteria were considered as having a positive screen result, denoting suggested SRD with respect to UV light. If students experienced none or only one of the 4 criteria, they were assigned a negative CAGE result. When comparing discrete variables, Fisher's exact tests were performed to determine statistical significance. The data were analyzed using software (STATA 7.0, StataCorp LP, College Station, Tex).

## RESULTS

In all, 385 students participated (response rate = 90%). Of the 385 participants, 10 were older than 30 years and their responses were excluded from this analysis. Only students who reported ever purposely tanning were asked to complete the CAGE questionnaire. Demographics, relevant history, self-reported tanning practices, and CAGE questionnaire responses are reported in Table I.

In this study, 76% of female students reported purposely tanning their skin versus 59% of male students ( $P = .001$ ). Of the female students, 42% reported using indoor tanning devices versus 17% of the male students ( $P = .000$ ). Of students surveyed, 9% purposefully tanned their skin 20 or more times per month.

Overall, 12% of the total sample, 18% of the self-reporting suntanners, and 28% of indoor tanners scored positively on the CAGE indicating SRD with regard to UV light. Of the students who reported purposely tanning their skin, 22% of female suntanners had positive CAGE results, compared with 8%

**Table II.** Self-reported motivations for UV light tanning

	All UV light tanners (n = 240)	Respondents scoring positively on the CAGE (n = 43)	Indoor tanning device users (n = 112)	Initial motivation for indoor tanning (n = 124)
To look better	75%	91%	82%	60%
To relax	41%	47%	44%	14%
To gain a protective base tan	34%	44%	41%	19%
For special events	25%	44%	46%	40%
To feel healthy	22%	30%	29%	8%
Social activity with friends	18%	21%	20%	11%
Peer pressure	3%	9%	4%	10%
Special price promotion	3%	9%	8%	10%
Medical reasons	2%	5%	4%	0%
Other (eg, work)	7%	0%	7%	2%

CAGE, Cut down, annoyed, guilty, eye-opener.

of male suntanners ( $P = .007$ ). Indoor tanning device users were much more likely to be flagged as potentially having a UV light disorder than nonusers (28% vs 12%,  $P = .000$ ). Students with friends and family members who used indoor tanning machines were significantly more likely than students without such friends and family to test positive ( $P = .000$  and  $P = .016$ , respectively). The likelihood of scoring positively on the CAGE increased as reported frequency of tanning increased.

The reasons respondents gave for tanning are reported in Table II.

### First indoor tanning experience

Of respondents, 66% reporting ever using an indoor tanning device were also current users (have used one within the last year). Of students reporting ever using an indoor tanning device, 49% had received a burn from indoor tanning device use, and 79% of these previously burned students still currently tanned indoors. The mean age of first using a tanning device was 16.8 years, and the range was 7 to 23 years. Of indoor tanners, 87 (71%) started before the age of 18 years and 12 (10%) at the age of 14 years or younger.

In all, 59% reported going to an indoor tanning salon for the first time with friends, 18% went alone, 14% went with their parents, and 11% with their siblings. Reasons respondents gave for using an indoor tanning device their first time are given in Table II.

### DISCUSSION

In all, 18% of undergraduate students who admitted to purposely tanning their skin scored positively on the CAGE questionnaire, indicating probable existence of SRD with respect to UV light. This number is significant and comparable with the 18% of drinking college students who scored positively on the CAGE questionnaire with respect to alcohol in

a Midwest study<sup>31</sup> and the 16% of college students who reported smoking cigarettes daily in a 2002 National Institutes of Health study.<sup>32</sup>

Many of our respondents also exhibited high-risk tanning behavior and had experienced a bad or blistering burn from the sun and indoor tanning devices. Of students surveyed, 9% purposefully tanned their skin 20 or more times per month. The tendency to sunburn, lifetime number of severe sunburns, and cumulative UV light exposure are all positively associated with risk of developing future skin cancer.<sup>33</sup> In addition, our study shows a strong positive correlation between high-risk tanning behavior and SRD with respect to UV light. Significantly more students scoring positively on the CAGE questionnaire had experienced a bad or blistering sunburn (63%) and many more of these students who were also indoor tanners had received a burn from an indoor tanning device (57%). Of students with SRD, 16% purposefully tanned their skin 20 or more times per month.

Students with a known family history of skin cancer are also at much greater risk of developing cancer<sup>4</sup> and surprisingly are significantly more likely to tan their skin than those without a family history of skin cancer. Of students with a positive family history, 77% purposely tanned their skin outdoors and 45% of them used indoor tanning devices. This finding is consistent with a previous study that found Midwestern college students with a positive family history of skin cancer were 1.5 times more likely to use tanning lamps than those without.<sup>19</sup> Personal experience apparently fails to alter tanning behavior. The association found in previous studies between frequent indoor tanners and tobacco and other substance abuse also suggests that individuals who tan frequently may be susceptible to multiple addictive disorders.<sup>34-36</sup>

Almost half of tanning students report tanning to relax, which is a strong motivating factor that has

been noted by numerous previous studies.<sup>13,19,37,38</sup> As expected of an addictive practice, established users in our study reported tanning to relax and to feel healthy much more often than first-time users (44% vs 14%). Furthermore, it has been shown that adolescents who agree that tanning improves their mood are more likely to self-report difficulty in quitting tanning.<sup>23</sup>

As previously discussed, education alone will probably not stop high-risk tanning behavior. Numerous studies examining other health behavior changes, particularly those of addictive behaviors, have shown that successful self-changers use different processes at each particular stage of change.<sup>39,40</sup> Future interventions should take into consideration the behavioral stage and motivational readiness of each individual to change problem tanning behavior. In addition, if, in fact, tanning is addictive, the argument to prohibit the use of indoor tanning devices by minors, as recommended by the World Health Organization,<sup>41</sup> is strengthened.

There are several limitations to our study. The sample size was small as was the group identified as positive for SRD. The behaviors of undergraduate college students at this university may not be able to be generalized over all undergraduate students or the general population. Students self-reported their tanning behavior and medical history, which is a potential subjective limitation. Some student respondents may have answered the CAGE items with less accuracy because of social desirability concerns.

## CONCLUSION

The prevalence of SRD with respect to UV light among college tanners helps explain why it has been particularly difficult to modify high-risk tanning behavior in adolescents and young adults. The existence of this SRD should strengthen arguments to increase regulations on the indoor tanning industry and further justify following in the lead of public health efforts that have successfully decreased use of other addictive carcinogens.

We would like to thank Courtney McNamara and Dylan Mart for their help with data collection, and Do Peterson, MS, for reviewing our survey tool and study design.

## REFERENCES

1. Thompson JF, Scolyer RA, Kefford RF. Cutaneous melanoma. *Lancet* 2005;365:687-701.
2. Beddingfield FC III. The melanoma epidemic: res ipsa loquitur. *Oncologist* 2003;8:459-65.
3. Green A. Sun exposure and the risk of melanoma. *Australas J Dermatol* 1984;25:99-102.
4. Holman CDJ, Armstrong BK. Pigmentary traits, ethnic origin, benign nevi, and family history as risk factors for cutaneous melanoma. *J Natl Cancer Inst* 1984;72:257-66.
5. Spencer JM, Amonette R. Tanning beds and skin cancer: artificial sun + old sol = real risk. *Clin Dermatol* 1998;16:487-501.
6. Holman CDJ, Armstrong BK. Relationship of cutaneous malignant melanoma to individual sunlight exposure habits. *J Natl Cancer Inst* 1986;76:403-14.
7. Zanetti R, Franceschi S, Rosso S, Colonna S, Bidoli E. Cutaneous melanoma and sunburns in childhood in a southern European population. *Eur J Cancer* 1992;28A:1172-6.
8. Stern RS, Weinstein MC, Baker SG. Risk reduction for non-melanoma skin cancer with childhood sunscreen use. *Arch Dermatol* 1986;122:537-45.
9. Council on Scientific Affairs. Harmful effects of ultraviolet radiation. *JAMA* 1989;262:380-4.
10. Walter SD, Marrett LD, Shannon HS, Roy P. The association of cutaneous malignant melanoma with the use of sunbeds and sunlamps. *Am J Epidemiol* 1990;131:232-43.
11. Levine JA, Sorace M, Spencer J, Siegel DM. The indoor UV tanning industry: a review of skin cancer risk, health benefit claims, and regulation. *J Am Acad Dermatol* 2005;53:1038-44.
12. Monfrecola G, Fabbrocini G, Posteraro G, Pini D. What do young people think about the dangers of sunbathing, skin cancer and sunbeds? A questionnaire survey among Italians. *Photodermatol Photoimmunol Photomed* 2000;16:15-8.
13. Mawn VB, Fleischer AB Jr. A survey of attitudes, beliefs, and behavior regarding tanning bed use, sunbathing, and sunscreen use. *J Am Acad Dermatol* 1993;29:959-62.
14. Arthey S, Clarke V. Suntanning and sun protection: a review of the psychological literature. *Soc Sci Med* 1995;40:265-74.
15. Robinson JK, Rademaker AW, Sylvester JA, Cook B. Summer sun exposure: knowledge, attitudes, and behaviors of midwest adolescents. *Prev Med* 1997;26:364-74.
16. Geller AC, Colditz G, Oliveria S, Emmons K, Jorgensen C, Aweh GN, et al. Use of sunscreen, sunburning rates, and tanning bed use among more than 10,000 US children and adolescents. *Pediatrics* 2002;109:1009-14.
17. Robinson JK, Rigel DS, Amonette RA. Trends in sun exposure knowledge, attitudes, and behaviors: 1986 to 1996. *J Am Acad Dermatol* 1996;34:179-86.
18. Benjes LS, Brooks DR, Zhang Z, Livstone L, Sayers L, Powers C, et al. Changing patterns of sun protection between the first and second summers for very young children. *Arch Dermatol* 2004;140:925-30.
19. Knight JM, Kirincich AN, Farmer ER, Hood AF. Awareness of the risks of tanning lamps does not influence behavior among college students. *Arch Dermatol* 2002;138:1311-5.
20. Netburn D. Young, carefree, and hooked on sunlamps. *New York Times* May 26, 2002;9.
21. Chedru MF, Dumont C, Jourdain F, Postel-Vinay N, Dab W. Cutaneous melanoma prevention: modify behaviors [in French]. *Rev Prat* 2004;54:1165-6.
22. WCCO-TV. Hooked on tanning? Available from: URL:[http://www.wcco.com/specialreports/local\\_story\\_052181257.html](http://www.wcco.com/specialreports/local_story_052181257.html). Accessed July 3, 2006.
23. Zeller S, Lazovich D, Forster J, Widome R. Do adolescent indoor tanners exhibit dependency? *J Am Acad Dermatol* 2006;54:589-96.
24. Feldman SR, Liguori A, Kucenic M, Rapp SR, Fleischer AB Jr, Lang W, et al. Ultraviolet exposure is a reinforcing stimulus in frequent indoor tanners. *J Am Acad Dermatol* 2004;51:45-51.
25. Levins PC, Carr DB, Fischer JE, Momtaz K, Parrish JA. Plasma beta-endorphin and beta-lipotropin response to ultraviolet radiation. *Lancet* 1983;2:166.
26. Belon PE. UVA exposure and pituitary secretion: variations of human lipotropin concentrations ( $\beta$ LPH) after UVA exposure. *Photochem Photobiol* 1985;42:327-9.

27. Warthan MM, Uchida T, Wagner RF Jr. UV light tanning as a type of substance-related disorder. *Arch Dermatol* 2005;141:963-6.
28. Ewing JA. Detecting alcoholism: the CAGE questionnaire. *JAMA* 1984;252:1905-7.
29. Brown RL. Identification and office management of alcohol and drug disorders. In: Fleming MF, Barry KL, editors. *Addictive disorders*. St Louis: Mosby; 1992. p. 28.
30. Mersy DJ. Recognition of alcohol and substance abuse. *Am Fam Physician* 2003;67:1529-32.
31. Boyd CJ, McCabe SE, d'Arcy H. A modified version of the CAGE as an indicator of alcohol abuse and its consequences among undergraduate drinkers. *Subst Abuse* 2003;24:221-32.
32. Johnston LD, O'Malley PM, Bachman JG. Monitoring the future national survey results on drug use, 1975-2002. Volume II: college students and adults ages 19-40 (National Institutes of Health publication No. 03-5376). Bethesda (MD): National Institute on Drug Abuse; 2003.
33. Abdulla FR, Feldman SR, Williford PM, Krowchuk D, Kaur M. Tanning and skin cancer. *Pediatr Dermatol* 2005;22:501-12.
34. Demko CA, Borawski EA, Debanne SM, Cooper KD, Stange KC. Use of indoor tanning facilities by white adolescents in the United States. *Arch Pediatr Adolesc Med* 2003;157:854-60.
35. Lazovich D, Forster J, Sorensen G, Emmons K, Stryker J, Demierre MF, et al. Characteristics associated with use or intention to use indoor tanning among adolescents. *Arch Pediatr Adolesc Med* 2004;158:918-24.
36. Boldeman C, Jansson B, Nilsson B, Ullen H. Sunbed use in Swedish urban adolescents related to behavioral characteristics. *Prev Med* 1997;26:114-9.
37. Diffey BL. Use of UV-A sunbeds for cosmetic tanning. *Br J Dermatol* 1986;115:67-76.
38. Dougherty MA, McDermott RJ, Hawkins MJ. A profile of commercial tanning salons. *Health Values* 1988;12:21-9.
39. Prochaska JO, Velicer WF, Rossi JS, Goldstein MG, Marcus BH, Rakowski W, et al. Stages of change and decisional balance for 12 problem behaviors. *Health Psychol* 1994;13:39-46.
40. Prochaska JO, DiClemente CC, Norcross JC. In search of how people change: applications to addictive behaviors. *Am Psychol* 1992;47:1102-14.
41. World Health Organization. *Artificial tanning sunbeds—risks and guidance*. Geneva: World Health Organization; 2003.

**4th International Workshop for the Study of Itch  
San Francisco, California  
September 9-11, 2007**

**Venue:** Hilton San Francisco Financial District, 750 Kearny Street, San Francisco, California 94108  
Phone: 415-433-6600; Fax: 415-765-7891; Web site:  
[http://www1.hilton.com/en\\_US/hi/hotel/SFOFDHF-Hilton-San-Francisco-Financial-District-California/index.do](http://www1.hilton.com/en_US/hi/hotel/SFOFDHF-Hilton-San-Francisco-Financial-District-California/index.do).

**Meeting organizers and contact:** Prof. Earl Carstens, M. Carstens, University of California, Davis, Section of Neurobiology, Physiology, & Behavior, 1 Shields Ave, Davis, CA 95616. Phone: 530-752-7767; Fax: 530-752-5582; E-mail: [ecarstens@ucdavis.edu](mailto:ecarstens@ucdavis.edu).

**Official meeting Web site:** <http://itch2007sanfrancisco.ucdavis.edu/>.