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Addiction to Indoor Tanning: Relations to Anxiety, Depression, and Substance Use

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Abstract

Objective—To assess the prevalence of addiction to indoor tanning among college students and its association with substance use and symptoms of anxiety and depression.

Design—Two written measures, the CAGE (*Cut down, Annoyed, Guilty, Eye-opener*) Questionnaire, used to screen for alcoholism, and the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (*DSM-IV-TR*) criteria for substance-related disorders, were modified to evaluate participants for addiction to indoor tanning. Standardized self-report measures of anxiety, depression, and substance use also were administered.

Setting—Large (i.e., approximately 18,000 students) university in the northeastern United States.

Participants—A total of 421 college students.

Main Outcome Measures—Self-reported addiction to indoor tanning, substance use, and symptoms of anxiety and depression.

Results—Among respondents who had used indoor tanning facilities (n = 229), 39% met *DSM-IV-TR* criteria and 31% met CAGE criteria for addiction to indoor tanning. Students who met *DSM-IV-TR* and CAGE criteria for addiction to indoor tanning reported greater symptoms of anxiety and greater use of alcohol, marijuana, and other substances than those who did not meet these criteria. Depressive symptoms did not significantly vary by indoor tanning addiction status.

Conclusions—Findings suggest that interventions to reduce skin cancer risk should address the addictive qualities of indoor tanning for a minority of individuals as well as the relationship of this behavior to other addictions and affective disturbance.

Keywords

skin cancer; tanning; addiction; anxiety; depression; substance use

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Extensive evidence has linked sunlamp or sun bed exposure to increased risk of both melanoma and nonmelanoma skin cancers.[1–3] Despite ongoing efforts to educate the public about the health risks associated with natural and nonsolar ultraviolet (UV) radiation, recreational tanning continues to increase among young adults.[4] In addition to the desire for appearance enhancement, motivations for tanning include relaxation, improved mood, and socialization.[5–7] These reinforcing properties of UV tanning have been conceptualized within an addiction framework.[8] That is, repeated exposure to UV light may result in a behavior pattern that is similar to other types of substance-related disorders (SRDs). In support of this hypothesis, a significant proportion (12% to 53%) of young adults and sunbathers has met criteria for having a SRD with respect to UV light tanning behavior.[7, 9–10] In addition, having a SRD involving tanning behavior and the use of indoor tanning devices have been positively associated with cigarette smoking among young adults.[9, 11] However, in-depth analyses of the reliability and validity of measures of SRD involving tanning behavior have not been conducted. Research also has not specifically focused on SRD with respect to indoor tanning and its relation to other psychopathology. We hypothesized that a significant minority of college students would meet the criteria for a SRD with respect to indoor tanning and that endorsement of this disorder would be positively related to anxiety, depression, and substance use.

Methods

A total of 421 undergraduates were recruited from the psychology department research participant pool at a state university in the northeastern United States during September to December 2006. All study materials and procedures were approved by the University at Albany's institutional review board. After providing written informed consent, participants anonymously completed questionnaires in groups ranging from 15 to 30 people. Participants reported their demographic information, frequency of indoor tanning during the past year, and whether they had ever tanned indoors.

To assess potential dependence on indoor tanning, we modified two measures that are widely used to identify SRDs: the 4-item CAGE (*Cut down, Annoyed, Guilty, Eye-opener*) Questionnaire,[12] which is used for alcoholism screening, and the seven diagnostic criteria for a SRD as outlined in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (*DSM-IV-TR*).[13] Versions of these measures were used in prior research to assess addiction to UV light tanning.[9–10] In this study, CAGE and *DSM-IV-TR* criteria referred to indoor tanning. Following the scoring procedures of Warthan and colleagues,[10] two or more affirmative responses to items on the modified CAGE (mCAGE) and three or more affirmative responses to items on the modified *DSM-IV-TR* (m*DSM-IV-TR*) were, respectively, classified as a probable SRD involving indoor tanning. Scoring procedures for 3 questions in the m*DSM-IV-TR* with multiple parts were as follows: (1) Question 1 was counted as affirmative only if both subparts were answered "yes." (2) Question 5 was counted as affirmative with 2 or 3 positive responses (any response other than "0" was classified as a positive response to subpart 5a). (3) Question 7 required a "no" response to subpart 7c and a "yes" response to subparts 7a and/or 7b to be considered an affirmative response. Internal consistencies for the mCAGE and m*DSM-IV-TR* were .58 and .56, respectively. Deletion of individual items did not significantly alter the alphas. The relatively low alphas are consistent with those found in prior research on SRD related to tanning behavior[9] and most likely reflect the wide range of behaviors assessed by the measures and their brevity.

Participants completed the Beck Anxiety Inventory (BAI)[14] and the Beck Depression Inventory (BDI),[15] which are widely used 21-item scales to assess symptoms of anxiety and depression during the past week, respectively. Internal consistencies for the BAI and BDI in

the present research were .91 and .87, respectively. In addition, participants completed portions of the Core Alcohol and Drug Survey (CADS),[16] a validated measure of substance use. Participants reported the number of days they had used 12 different substances (e.g., tobacco, alcohol, marijuana) during the past month. Response choices were 0 days, 3–5 days, 6–9 days, 10–19 days, 20–29 days, and all 30 days.

Descriptive statistics were used to characterize the sample's demographics, use of indoor tanning facilities, and indoor tanning addiction status. "Addiction" to indoor tanning was defined as meeting both mCAGE and m*DSM-IV-TR* criteria for addiction. Students with "addictive tendencies" met the criteria for addiction on either the mCAGE or m*DSM-IV-TR*. Students' frequency of indoor tanning during the past year and endorsement of items from the mCAGE and m*DSM-IV-TR* were computed according to indoor tanning addiction status. Pearson χ^2 tests were used to examine associations between mCAGE, m*DSM-IV-TR*, and demographic factors (sex, skin type[17]). Logistic regression models were used to examine students' frequency of indoor tanning during the past year, anxiety, depressive symptoms, and substance use as predictors of indoor tanning addiction status. Substance use variables included the use of tobacco, alcohol, and marijuana as well as the use of stimulants (i.e., cocaine, amphetamines, and/or the nicotine in tobacco). Other substance categories were not analyzed due to the small number of substance users (*n*s = 1–14), which would compromise the validity of the results.[18] In addition, use of depressants (alcohol, marijuana, sedatives, and/or opiates) was not analyzed because only 5 students with addictive tendencies or addiction to indoor tanning did not report use of these substances. Finally, Pearson χ^2 tests were used to examine relations among anxiety, depression, the number of substances used during the past month (excluding alcohol), and lifetime use of indoor tanning devices and tanning addiction status. Alcohol use was excluded from these analyses because only 5 students with addictive tendencies or addiction to indoor tanning did not report alcohol use.

Results

Demographic characteristics of the sample appear in Table 1. When asked whether they had ever tanned indoors, the majority of the sample (56%; *n* = 237) answered affirmatively. Data from 8 of the 237 people who had tanned indoors were omitted from subsequent analyses due to missing values on the mCAGE or m*DSM-IV-TR* measures. Mean number of visits to tanning salons during the past year among respondents with a lifetime history of indoor tanning was 23 (*SD* = 24). In addition, almost one-third of these participants (31%; *n* = 70) met mCAGE criteria and 39% (*n* = 90) met m*DSM-IV-TR* criteria for addiction to indoor tanning. The mCAGE and m*DSM-IV-TR* results were significantly correlated (κ = .43, *P* < .001; Table 2) and were not significantly associated with sex or skin type (*P*s = .12-.43).

Frequency of indoor tanning during the past year and endorsement of items from the mCAGE and m*DSM-IV-TR* by tanning addiction status are found in Table 3. Students who met criteria for addiction to indoor tanning reported more indoor tanning sessions during the past year than those with addictive tendencies (see Table 4). In addition, both of these groups reported more indoor tanning sessions during the past year than those who did not meet the criteria for addiction to indoor tanning. Clinical categories of anxiety symptoms did not significantly vary as a function of lifetime use of indoor tanning devices or tanning addiction status (*P* = .07; see Table 5). However, as shown in Table 4, students who met criteria for addiction to indoor tanning on both the mCAGE and m*DSM-IV-TR* reported greater symptoms of anxiety than those who were not addicted to indoor tanning. Depressive symptoms did not significantly vary by lifetime use of indoor tanning devices or tanning addiction status. When anxiety, depressive symptoms, and frequency of indoor tanning during the past year were included in the same logistic regression model, only frequency of

indoor tanning significantly predicted tanning addiction status (addicted vs. not addicted; Wald χ^2= 16.55, OR = 1.03, $p < .001$).

Alcohol use during the past month was endorsed by 92% of students who had tanned indoors, whereas the rates of tobacco and marijuana use during the past month were 36% and 37%, respectively. Other substances (e.g., cocaine, amphetamines, opiates, steroids) were used by a small minority of students (range = .4% to 6%) during the past month. Although tobacco use and use of stimulants (cocaine, amphetamines, and/or the nicotine in tobacco) did not differ by tanning addiction status, students who met criteria for addictive tendencies or addiction to indoor tanning reported greater alcohol and marijuana use during the past month than those who did not meet these criteria (see Table 4). In addition, the number of substances used during the past month other than alcohol varied by lifetime use of indoor tanning devices and tanning addiction status (see Table 5). The highest rate of substance use was found among those who met criteria for addiction to indoor tanning, with 42% endorsing use of two or more substances during the past month. Only 16% of students who had never tanned indoors and 17% of indoor tanners who were not addicted to this behavior endorsed this degree of substance use.

Comment

This study provides further support for the notion that tanning may be conceptualized as an addictive behavior for a subgroup of individuals who tan indoors[8] and extends prior work by relating indoor tanning addiction to substance use and affective disturbance. Among college students who had tanned indoors, 31% met mCAGE criteria and 39% met m*DSM-IV-TR* criteria for addiction to indoor tanning. Similarly, Poorsattar and colleagues[7] found that 28% of undergraduates who had tanned indoors met mCAGE criteria for addiction to tanning. In this study, greater use of indoor tanning devices was associated with greater likelihood of addiction to this behavior, which supports the construct validity of the measures. The lack of association between skin type and addiction to indoor tanning may be due to the underrepresentation of darker skin tones. In addition, sex was not associated with addiction to indoor tanning, as in prior research on SRD involving UV light tanning.[9–10] Women were overrepresented in this study and previous research,[9–10] and, thus, further studies with gender-balanced samples are needed.

An interesting pattern of findings emerged regarding the relations between substance use and SRD involving indoor tanning. Forty-two percent of indoor tanners with positive m*DSM–IV-TR* and mCAGE responses reported use of two or more substances during the past month (excluding alcohol), whereas 17% of indoor tanners with negative m*DSM-IV-TR* and mCAGE responses and 16% of those who had never tanned indoors reported this degree of substance use. Furthermore, students who met criteria for addiction to indoor tanning on either the m*DSM–IV-TR* or mCAGE reported greater use of alcohol and marijuana compared with those who did not meet these criteria. Other studies have found positive associations between substance use and indoor tanning among adolescents and young adults.[11, 19–20] In this study, tobacco use and the use of stimulants (cocaine, amphetamines, and/or the nicotine in tobacco) did not differ by tanning addiction status, whereas another study found a positive association between cigarette smoking and addiction to tanning.[9] Overall, findings suggest that individuals who use drugs may be more likely to develop dependence on indoor tanning due to a similar addictive process. In addition, both tanning and drug use may be reinforced by peer group norms.

Anxiety and depression are often comorbid with substance dependence,[21] and the present findings suggest that affective disturbance may also be comorbid with dependence on indoor tanning. Specifically, indoor tanners with positive m*DSM–IV-TR* and mCAGE responses

had approximately twice the rate of moderate to severe anxiety and depressive symptoms than tanners with negative responses on both measures and those who had never tanned indoors. Similarly, prior research found a positive association between seasonal affective disorder and indoor tanning frequency.[22] In this study, however, anxiety symptoms predicted group classification (i.e., positive vs. negative m*DSM–IV-TR* and mCAGE responses), whereas depressive symptoms did not predict this classification. In addition, students with addictive tendencies (either positive m*DSM–IV-TR* or mCAGE responses) had levels of anxiety and depressive symptoms that did not significantly differ from those who were not addicted to indoor tanning.

If associations between affective factors and indoor tanning behavior are replicated, results suggest that treating an underlying mood disorder may be a necessary step in reducing skin cancer risk among frequent indoor tanners. Researchers have hypothesized that regular, year-round tanners may require more intensive intervention efforts, such as motivational interviewing, relative to those who tan periodically in response to mood changes or special events.[23–24] Further research should evaluate the utility of incorporating a brief anxiety and depression screening for patients who tan indoors. Patients who evidence anxiety or depression could be referred to mental health professionals for diagnosis and treatment.

Limitations of this study include its cross-sectional design and reliance on self-report measures. In addition, the sample consisted of undergraduate students in the northeastern U.S., and, thus, results may not generalize across individuals of different age groups, socioeconomic levels, and geographic regions. Although results supported the convergent validity of our new self-report measures of addiction to indoor tanning, the alphas were relatively low. Alphas tend to underestimate reliability, especially when measures contain fewer than 10 items.[25] Further reliability testing and in-depth analyses of the measures, such as cognitive interviewing, should be conducted in future studies to strengthen their validity for use with tanners. For example, use of cognitive interviewing would allow researchers to ascertain whether affirmative responses to item 1a indicate a preoccupation with tanning or agreement with the notion that more time spent tanning darkens the skin. Research is needed to further validate the self-report measures of addiction to indoor tanning by including objective measures of UV radiation exposure (e.g., spectrophotometry). It also would be interesting to explore the physiological and psychological mechanisms underlying the relations among addiction to indoor tanning, other addictive behaviors, and affective disturbance. Such research would inform biopsychosocial conceptualizations of tanning behavior and tailored interventions that address individuals' motivations for tanning and their relation to psychopathology.

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Table 1

Demographic Characteristics of Study Participants

Characteristic	No. (%) of Participants (*N* = 421)
Sex	
Female	284 (67.5)
Male	133 (31.6)
Not reported	4 (1.0)
Age, years	
18–19	313 (74.3)
20–21	78 (18.5)
22–24	20 (4.8)
25+	6 (1.4)
Not reported	4 (1.0)
Skin type	
Burn, never tan	6 (1.4)
Burn easy, then develop light tan	51 (12.1)
Burn moderately, then develop light tan	70 (16.6)
Burn minimally, then develop moderate tan	167 (39.7)
Don’t burn, develop dark tan	111 (26.4)
Don’t burn, no noticeable change in appearance	10 (2.4)
Not reported	6 (1.4)
Lifetime use of indoor tanning devices	
Yes	237 (56.3)
No	181 (43.0)
Not reported	3 (0.7)

Table 2

Association between mCAGE and m*DSM-IV-TR* Findings[***]

	m*DSM-IV-TR*		
mCAGE	**Negative**	**Positive**	**Total, No. (%)**
Negative	119	40	159 (69)
Positive	20	50	70 (31)
Total, No. (%)	139 (61)	90 (39)	229 (100)

Abbreviations: mCAGE, modified CAGE (*Cut down, Annoyed, Guilty, Eye-opener*) Questionnaire;[12] m*DSM-IV-TR*, modified *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*[13] criteria.

[***] $p < .001$.

Table 3

mCAGE and m*DSM-IV-TR* Responses and Indoor Tanning Frequency by Tanning Addiction Status

	Not Addicted to Indoor Tanning *N* = 119 *n* (%)	Addictive Tendencies *N* = 60 *n* (%)	Addicted to Indoor Tanning *N* = 50 *n* (%)
mCAGE			
1. Do you try to cut down on the time you spend in tanning beds or booths, but find yourself still tanning? **YES** NO	6 (5)	13 (22)	39 (78)
2. Do you ever get annoyed when people tell you not to use tanning beds or booths? **YES** NO	19 (16)	25 (42)	41 (82)
3. Do you ever feel guilty that you are using tanning beds or booths too much? **YES** NO	15 (13)	22 (37)	39 (78)
4. When you wake up in the morning do you want to use a tanning bed or booth? **YES** NO	3 (3)	8 (13)	13 (26)
m*DSM-IV-TR*			
1. a) Do you think you need to spend more and more time in tanning beds or booths to maintain your perfect tan? **YES** NO	15 (13)	33 (55)	27 (54)
b) Do you think your tan will fade if you spend the same amount of time in a tanning bed or booth each time? **YES** NO	5 (4)	10 (17)	11 (22)
2. Do you continue to use tanning beds or booths so your tan will not fade? **YES** NO	27 (23)	49 (82)	47 (94)
3. When you go to tanning salons, do you usually spend more time in the tanning bed or booth than you had planned? **YES** NO	2 (2)	3 (5)	6 (12)
4. Do you try other non-tanning related activities, but find you really still like spending time in tanning beds or booths best of all? **YES** NO	7 (6)	10 (17)	20 (40)
5. a) How many days a week do you spend in tanning beds or booths? 0 **1 2 3 4 5 6 7**	42 (35)	52 (87)	46 (92)
b) Do you tan year round? **YES** NO	21 (18)	36 (60)	46 (92)
c) Have you ever missed work, a social engagement, or school because of a burn from tanning bed or booth use? **YES** NO	0 (0)	1 (2)	3 (6)
6. Have you ever missed any scheduled activity (social, occupational, recreational activities) because you decided to use tanning beds or booths? **YES** NO	2 (2)	1 (2)	6 (12)
7. a) Do you believe you can get skin cancer from the sun? **YES** NO	118 (99)	58 (97)	49 (98)
b) From tanning beds or booths? **YES** NO	117 (98)	60 (100)	50 (100)
c) Does this keep you from spending time in the sun or using tanning beds or booths? YES **NO**	73 (61)	51 (85)	49 (98)
Frequency of indoor tanning during the past year			
Mean (Standard Deviation)	13 (17)	28 (22)	40 (28)

Affirmative responses appear in bold. (Note: a “no” reply to question 7c in combination with a “yes” reply to 7a and/or 7b is considered an affirmative response.) mCAGE indicates modified CAGE (*Cut down, Annoyed, Guilty, Eye-Opener*) Questionnaire[12]; m*DSM-IV-TR*, modified *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*[13] criteria. Positive mCAGE and m*DSM-IV-TR* responses indicate “addiction to indoor tanning.” Positive responses to either the mCAGE or m*DSM-IV-TR* indicate “addictive tendencies.”

Table 4

Predictors of Indoor Tanning Addiction Status

	Not Addicted to Indoor Tanning vs. Addictive Tendencies			Not Addicted vs. Addicted to Indoor Tanning			Addictive Tendencies vs. Addicted to Indoor Tanning		
	Wald χ^2	Odds Ratio	95% CI	Wald χ^2	Odds Ratio	95% CI	Wald χ^2	Odds Ratio	95% CI
Frequency of indoor tanning during the past year	15.78	1.04***	1.02 to 1.06	26.54	1.05***	1.03 to 1.07	5.38	1.02*	1.00 to 1.04
Anxiety	.13	1.01	.97 to 1.04	4.24	1.03*	1.00 to 1.07	2.42	1.03	.99 to 1.07
Depressive symptoms	.39	1.02	.97 to 1.07	.54	1.02	.97 to 1.07	.03	1.01	.95 to 1.06
Tobacco use	.47	.94	.79 to 1.12	.69	1.07	.91 to 1.26	1.56	1.13	.93 to 1.37
Alcohol use	5.50	1.34*	1.05 to 1.71	6.01	1.40*	1.07 to 1.84	.06	1.04	.77 to 1.41
Marijuana use	6.28	1.36*	1.07 to 1.73	4.38	1.33*	1.02 to 1.74	.09	.96	.74 to 1.24
Use of stimulants[a]	.00	.99	.52 to 1.87	1.26	1.47	.75 to 2.85	1.04	1.49	.69 to 3.18

Positive mCAGE and m*DSM-IV-TR* responses indicate “addiction to indoor tanning.” Positive responses to either the mCAGE or m*DSM-IV-TR* indicate “addictive tendencies.”

[a]Stimulants include cocaine, amphetamines, and the nicotine in tobacco.

*$p < .05$.

***$p < .001$.

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Table 5

Anxiety, Depression, and Substance Use by Lifetime History of Indoor Tanning and Tanning Addiction Status

	No Lifetime Indoor Tanning History *N* = 181 *n* (%)	**Not Addicted to Indoor Tanning *N* = 119 *n* (%)**	**Addictive Tendencies *N* = 60 *n* (%)**	**Addicted to Indoor Tanning *N* = 50 *n* (%)**	χ^2
Beck Anxiety Inventory scores					11.81†
None (0–9)	119 (66)	71 (60)	32 (53)	22 (44)	
Mild to moderate (10–18)	40 (22)	30 (25)	16 (27)	14 (28)	
Moderate to severe (19–63)	21 (12)	18 (15)	12 (20)	14 (28)	
Missing data	1 (.6)	0 (0)	0 (0)	0 (0)	
Beck Depression Inventory scores					4.28
None (0–9)	127 (70)	80 (67)	39 (65)	33 (66)	
Mild to moderate (10–18)	41 (23)	34 (29)	15 (25)	11 (22)	
Moderate to severe (19–63)	9 (5)	5 (4)	5 (8)	5 (10)	
Missing data	4 (2)	0 (0)	1 (2)	1 (2)	
Number of substances used during the past month (excluding alcohol)					22.78**
0	103 (57)	58 (49)	24 (40)	19 (38)	
1	47 (26)	41 (34)	22 (37)	10 (20)	
2+	29 (16)	20 (17)	14 (23)	21 (42)	
Missing data	2 (1)	0 (0)	0 (0)	0 (0)	

Positive mCAGE and m*DSM-IV-TR* responses indicate “addiction to indoor tanning.” Positive responses to either the mCAGE or m*DSM-IV-TR* indicate “addictive tendencies.”

$^{\dagger}p < .10$.

$^{**}p < .01$.