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## Indoor Tanning, Mental Health, and Substance Use among College Students: The Significance of Gender

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### Abstract

This study examined relations among indoor tanning frequency, symptoms of depression, anxiety, and obsessive-compulsive disorder, and substance use. A total of 421 college students (68% female) completed self-report measures on one occasion. Among men, indoor tanning was positively associated with symptoms of anxiety and obsessive-compulsive disorder, whereas indoor tanning was unrelated to these symptoms among women. Among women, indoor tanning was positively associated with the use of alcohol, tobacco, and other substances. Further research is needed to explore contextual and coping processes that may underlie these gender differences.

### Keywords

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

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Sunlamp or sun bed exposure increases risk of basal cell and squamous cell skin cancers and malignant melanoma (Gallagher, Spinelli, & Lee, 2005; Karagas et al., 2002; Veierød et al., 2003). Use of indoor tanning devices is especially popular among female adolescents and young adults (Demko, Borawski, Debanne, Cooper, & Stange, 2003; Robinson, Kim, Rosenbaum, & Ortiz, 2008). Although the primary motivation for indoor tanning is appearance enhancement, other psychosocial factors may influence this behavior, including a desire for relaxation, socialization, and improved mood (Feldman et al., 2004; Kaur et al., 2006; Poorsattar & Hornung, 2007). For example, Hillhouse and colleagues (2005) found a positive relationship between frequent indoor tanning and symptoms of seasonal affective disorder (SAD) in undergraduate women. Another study found that individuals with a high level of appearance motivation and obsessive compulsive tendencies (e.g., difficulty stopping unpleasant thoughts, frequent checking behavior) were more likely to use tanning beds (Leary, Saltzman, & Georgeson, 1997). Thus, preliminary evidence suggests that frequent indoor tanning may be partially motivated by affective factors.

Affective factors, including emotional disturbance, may underlie the positive associations that have been found between indoor tanning tendencies and substance use. Specifically, indoor tanning was positively associated with cigarette smoking and risky alcohol use among adolescent girls and young adults (Heckman, Coups, & Manne, 2008; O’Riordan et al., 2006). In addition, adolescents who reported using 2 or 3 substances were more likely to tan indoors (Demko et al., 2003).

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Relationships among indoor tanning, substance use, and affective disturbance may be conceptualized from a coping or physiological perspective (Nolan, Taylor, Liguori, & Feldman, 2009). Coping models maintain that some people use substances or tan indoors to enhance positive affect, diminish negative affect, and provide distraction or escape from environmental demands (Brandon, Herzog, Irvin, & Gwaltney, 2004; Nolan et al., 2009). From a physiological perspective, exposure to substances increases the amount of dopamine in the nucleus accumbens, which is responsible for the rewarding properties of many drugs of abuse (Golan, Tashjian, Armstrong, & Armstrong, 2008). A similar mechanism may underlie the pleasurable effects of ultraviolet radiation (UVR) exposure. Specifically, endogenous opioids may be released during UVR exposure, which inhibit neurons that produce GABA and thereby increase dopamine release in the nucleus accumbens (Nolan et al., 2009). This model has received mixed empirical support; two studies found increased plasma levels of endorphins during UVR exposure (Belon, 1985; Levins, Carr, Fisher, Momtaz, & Parrish, 1983), whereas two other studies did not demonstrate this effect (Gambichler et al., 2002; Wintzen et al., 2001).

To date, studies of indoor tanning have primarily focused on its relation to tobacco and alcohol use and have not included general measures of depression and anxiety. In the present study of college students, we hypothesized that indoor tanning frequency would be positively associated with symptoms of anxiety, depression, and obsessive-compulsive disorder (OCD) as well as the use of tobacco, alcohol, marijuana, and other substances. Due to known gender differences in the prevalence of affective disorders, substance use, and indoor tanning (Demko et al., 2003; Presley, Meilman, & Lyerla, 1994; Zahn Waxler, Shirtcliff, & Marceau, 2008), we explored whether the pattern of associations among study variables differed between men and women. Although little is known regarding the relationship between mood and tanning among men, some women have reported tanning for affective reasons (Hillhouse, Turrisi, & Shields, 2007). Although greater substance use has been associated with indoor tanning among male and female adolescents (Demko et al., 2003), correlations between use of specific substances and tanning have not been examined by gender.

## Method

### Participants and Procedure

A total of 421 undergraduates were recruited from the psychology department research participant pool at a state university in the northeastern United States. All study materials and procedures were approved by the university's institutional review board. After providing written informed consent, participants anonymously completed questionnaires in groups ranging from 15 to 30 people.

Demographic characteristics of the sample appear in Table 1. The majority of participants were female (68%), Caucasian (73%), and 18–21 years of age (93%) and had sun-sensitive skin types (Mahler, Kulik, Gibbons, Gerrard, & Harrell, 2003). None of the participants reported a personal history of skin cancer.

### Measures

**Indoor tanning**—Participants reported whether they had ever tanned indoors and their frequency of indoor tanning during the past year. The latter measure was associated with daily diary assessment of indoor tanning and was unrelated to social desirability (Hillhouse, Turrisi, Holwiski, & McVeigh, 1999).

**Symptoms of anxiety, depression, and OCD**—Participants completed the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988) and the Beck Depression Inventory (BDI; Beck, 1978), which are 21-item scales to assess symptoms of anxiety and depression during the past week, respectively. The measures have been found to be reliable and valid for use with clinical and college student populations (Beck, 1978; Beck et al., 1988; Borden, Peterson, & Jackson, 1991; Bumberry, Oliver, & McClure, 1978). Internal consistencies for the BAI and BDI in the present research were .91 and .87, respectively. Participants also completed the revised Obsessive-Compulsive Inventory (OCI-R; Foa et al., 2002), which is an 18-item measure of OCD symptoms. Research has supported the reliability and validity of this scale for use with clinical and college student populations (Foa et al., 2002; Hajcak, Huppert, Simons, & Foa, 2004). Participants were asked to indicate how much each experience (e.g., “I check things more often than necessary”) had distressed or bothered them during the past month on a scale from 0 (*not at all*) to 4 (*extremely*). Internal consistency for the OCI-R in the present study was .90.

**Substance use**—Participants completed portions of the Core Alcohol and Drug Survey (CADS; Presley et al., 1994), a validated measure of substance use that has been widely used with college students. Participants reported the average number of drinks that they consumed per week and the number of times that they had engaged in binge drinking (i.e., consumed 5 or more drinks in one sitting) during the past two weeks. Participants also reported the number of days that they had used 12 different substances (e.g., tobacco, alcohol, marijuana, opiates, inhalants) 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.

### Statistical Analyses

Descriptive statistics were used to characterize the sample’s demographics and use of indoor tanning facilities. Non-parametric tests were used due to non-normally distributed measures (e.g., substance use, frequency of indoor tanning). First, a Pearson  $\chi^2$  test was performed to examine indoor tanning during the past year by gender. A Mann-Whitney U-test also was performed to examine participants’ number of indoor tanning sessions during the past year by gender. Then Spearman correlations were computed for men and women separately to examine relations among their number of indoor tanning sessions during the past year and symptoms of anxiety, depression, and OCD and substance use. Certain substance categories (e.g., opiates, inhalants, designer drugs, steroids) were not analyzed due to the small number of substance users ( $n = 1-6$ ) (Tabachnick & Fidell, 2001). Finally, Pearson  $\chi^2$  tests were conducted for men and women separately to examine relations among categories of indoor tanning and anxiety, depression, and obsessive-compulsive symptoms and substance use. Following the approach of O’Riordan and colleagues (2006), indoor tanning during the past year was categorized as follows: (1) no indoor tanning, (2) infrequent indoor tanning (1–9 tanning sessions), and (3) frequent indoor tanning (10+ tanning sessions). All reported  $p$  values are 2-sided and a value of  $p < .05$  was considered statistically significant.

## Results

### Descriptive Statistics

The majority of the sample (56.3%), all of whom were attending college in the northeastern United States, had a history of indoor tanning, and 47.7% reported that they had visited a tanning salon at least once during the past year (see Table 1). Tanning salon use during the past year varied by gender,  $\chi^2(1, n = 408) = 50.15, p < .0001$ , with 59.5% of women and 24.1% of men reporting at least one indoor tanning session. In another study of college students in the northeastern United States, a similar percentage of women (56.8%) and a smaller percentage of men (15.9%) had visited a tanning salon during the past year (Danoff-

Burg & Mosher, 2006). In this sample, the mean number of indoor tanning sessions during the past year was 12 ( $SD = 21$ ), and women reported more sessions during the past year relative to men ( $M_s = 16$  vs. 5, respectively; Mann-Whitney U-test;  $z = -7.15$ ,  $p < .001$ ).

On average, participants reported minimal depressive symptoms ( $M = 7.6$ ,  $SD = 6.6$ ) and mild anxiety ( $M = 10.0$ ,  $SD = 9.4$ ). Levels of anxiety and depression were comparable to those reported for other college student samples (Contreras, Fernandez, Malcarne, Ingram, & Vaccarino, 2004). The mean level of obsessive-compulsive symptoms ( $M = 13.7$ ,  $SD = 12.0$ ) also was similar to that of college students in prior research (Hajcak et al., 2004).

The 30-day prevalence of alcohol use was 82%, and the mean number of alcoholic drinks consumed per week was 8.1 ( $SD = 8.5$ ). In addition, 71% of participants reported heavy drinking (i.e., consuming 5 or more alcoholic drinks in one sitting) during the past 2 weeks. In contrast, 40% of college students in a nationally representative survey reported heavy drinking during the past 2 weeks, and the 30-day prevalence of alcohol use was 70% (O'Malley & Johnston, 2002). The 30-day prevalence of marijuana use in this sample also was higher than college student norms (34% vs. 20%, respectively; O'Malley & Johnston, 2002). The 30-day prevalence of tobacco use, however, was comparable to college student norms (31% vs. 30%, respectively; O'Malley & Johnston, 2002). As in prior research with college students (Presley et al., 1994), the other substances (e.g., cocaine, amphetamines, steroids) were used by a small minority of participants (range = 0.2% to 4.0%).

### Correlates of Indoor Tanning Frequency by Gender

Correlations between participants' number of indoor tanning sessions during the past year and study variables are found in Table 2. Psychological correlates of indoor tanning varied by gender. Among men, symptoms of anxiety and OCD were positively associated with indoor tanning, whereas these symptoms were not associated with indoor tanning among women. Clinical categories of anxiety also varied according to men's indoor tanning status for the past year (see Table 3). Thirty-five percent of men who frequently tanned indoors showed moderate to severe anxiety, whereas only 8% of infrequent indoor tanners and 9% of those who did not tan indoors showed this level of anxiety. Although a higher percentage of men who tanned indoors were classified as having probable OCD than those who did not tan indoors, this difference was not statistically significant. Depressive symptoms were not correlated with indoor tanning for both men and women.

Relations among substance use variables and indoor tanning also were examined by gender. Use of five substances in the past month (tobacco, alcohol, marijuana, cocaine, amphetamine) and alcohol use variables (i.e., frequency of 5 or more drinks in the past two weeks, average number of drinks per week) were positively associated with indoor tanning among women. For men, none of the substance use variables were correlated with indoor tanning.

Finally, the number of substances used during the past month other than alcohol varied by women's indoor tanning history (see Table 3). Twenty-eight percent of women who frequently tanned indoors reported using two or more substances during the past month, whereas only 9% of infrequent indoor tanners and 8% of women who did not tan indoors reported this degree of substance use. Among men, the number of substances used during the past month did not vary by indoor tanning history.

## Discussion

The present study examined patterns of associations between indoor tanning frequency, symptoms of depression, anxiety, and OCD, and substance use by gender. Interestingly,

anxiety was positively associated with indoor tanning among men and unrelated to indoor tanning among women. The self-selected nature of the sample may partially explain these findings. Although women's anxiety did not differ from that of non-clinical samples, men's anxiety was higher than norms for male college students ( $M_s = 8.9$  vs.  $7.3$ , respectively; Contreras et al., 2004). In this sample, the prevalence of moderate to severe anxiety symptoms was higher among men who frequently tanned indoors than those who did not, suggesting that tanning may be a means of coping with affective disturbance. Conversely, prior research indicates that appearance enhancement for special events is the primary reason for indoor tanning among college women, and less than 20% report affective reasons for tanning (Hillhouse et al., 2007).

Obsessive-compulsive symptoms also were positively associated with indoor tanning among men and unrelated to indoor tanning among women. Having a probable OCD diagnosis, however, was not associated with frequent tanning among men. Another study found no direct association between indoor tanning and obsessive-compulsive tendencies in a community sample of men and women, but found that high appearance motivation and obsessive-compulsive tendencies were associated with indoor tanning (Leary et al., 1997). Further research is needed to replicate this finding and to explore potential gender differences in the relations between OCD, appearance motivation, and tanning behavior.

Among men and women, depressive symptoms showed no significant association with indoor tanning. A small proportion of men and women reported moderate to severe depressive symptoms, and, thus, the restricted range of depressive symptoms may have influenced the results. In addition, we assessed general depressive symptoms during the past week rather than seasonal depressive episodes (SAD), which have been correlated with indoor tanning among college women (Hillhouse et al., 2005).

Relations between indoor tanning and substance use varied by gender. Among women, indoor tanning was positively associated with the use of five substances and most strongly associated with alcohol use, including binge drinking and their average number of drinks per week. In addition, women who frequently tanned indoors used a greater number of substances during the past month than those who did not frequently tan indoors. Conversely, among men, indoor tanning was unrelated to the number of substances used in the past month as well as the use of tobacco, alcohol, and marijuana. Results are not consistent with prior research that found positive associations between indoor tanning and substance use in male and female adolescents and young adults (Demko et al., 2003; Heckman et al., 2008; O'Riordan et al., 2006). However, this research only focused on the use of tobacco, alcohol, and marijuana, and, with one exception (Demko et al., 2003), data were not analyzed by gender. Reasons for gender differences in the current pattern of results are unclear. One potential explanation is that women experience more peer pressure to tan for appearance enhancement, and women who are more influenced by peer pressure may be more likely to engage in alcohol and other drug use. The media also may reinforce women's tanning and substance use. Further research may explore whether similar coping processes or physiological mechanisms (e.g., increased dopamine in the nucleus accumbens) underlie positive associations between indoor tanning and the use of various substances (Nolan et al., 2009). Personality factors, such as risk-taking and sensation seeking tendencies, also may be examined as potential predictors of both indoor tanning and substance use (Dunlop & Romer, in press).

This study is limited by its reliance on self-report measures and cross-sectional design. In addition, the number of men who tanned indoors was relatively small, and, thus, findings warrant replication in larger samples. Finally, results from a relatively homogenous college student sample in the northeastern U.S. may not necessarily generalize to individuals of



different ages, socioeconomic levels, and geographic locations. Despite limitations, findings suggest that individual difference variables (e.g., gender, coping strategies) and contextual factors (e.g., peer influences) warrant investigation as potential moderators of associations among tanning behavior, substance use, and psychopathology.

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**Table 1**

## Sample Characteristics

Characteristic	No. (%) of Participants (N = 421)
Gender	
Female	284 (67.5)
Male	133 (31.6)
Not reported	4 (1.0)
Ethnicity	
Caucasian	309 (73.4)
Hispanic	40 (9.5)
Asian/Asian American	27 (6.4)
African American	26 (6.2)
Other	15 (3.6)
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)
Personal history of indoor tanning	
Yes	237 (56.3)
No	181 (43.0)
Not reported	3 (0.7)

**Table 2**

Correlations between Frequency of Indoor Tanning and Study Variables by Gender

Study Variable	Frequency of Indoor Tanning during the Past Year	
	Men	Women
Anxiety	.24**	.06
Depressive symptoms	.12	.02
Obsessive-compulsive symptoms	.20*	.00
Frequency of 5+ alcoholic drinks in the past two weeks	.15	.36***
Average number of alcoholic drinks per week	.01	.44***
Frequency of use in the past 30 days		
Tobacco	-.01	.16**
Alcohol	.12	.42***
Marijuana	-.12	.26***
Cocaine	-	.16**
Amphetamine	-	.18**

Note. Spearman correlations are reported. Some correlations could not be computed due to the small number of people who reported substance use.

\*  
 $p < .05$ .

\*\*  
 $p < .01$ .

\*\*\*  
 $p < .0001$ .

**Table 3**  
Mental Health Outcomes and Substance Use by Gender and Indoor Tanning History

	Men				Women				$\chi^2$
	No Indoor Tanning N = 101 % (n)	Infrequent Indoor Tanning N = 12 % (n)	Frequent Indoor Tanning N = 20 % (n)	No Indoor Tanning N = 106 % (n)	Infrequent Indoor Tanning N = 35 % (n)	Frequent Indoor Tanning N = 134 % (n)			
Beck Anxiety Inventory scores									7.83
None (0–9)	66 (67)	67 (8)	45 (9)	67 (71)	51 (18)	53 (71)			
Mild to moderate (10–18)	25 (25)	25 (3)	20 (4)	16 (17)	34 (12)	27 (36)			
Moderate to severe (19–63)	9 (9)	8 (1)	35 (7)	17 (18)	14 (5)	20 (27)			
Beck Depression Inventory scores									2.19
None (0–9)	72 (73)	67 (8)	55 (11)	70 (74)	66 (23)	66 (89)			
Mild to moderate (10–18)	21 (21)	33 (4)	40 (8)	22 (23)	31 (11)	26 (35)			
Moderate to severe (19–63)	5 (5)	0 (0)	5 (1)	6 (6)	3 (1)	7 (10)			
Missing data	2 (2)	0 (0)	0 (0)	3 (3)	0 (0)	0 (0)			
Revised Obsessive-Compulsive Inventory scores									2.50
No OCD (0–20)	81 (82)	67 (8)	70 (14)	74 (78)	86 (30)	73 (98)			
Probable OCD (21–72)	19 (19)	33 (4)	30 (6)	26 (28)	14 (5)	27 (36)			
Number of substances used during the past month (excluding alcohol)									22.38**
0	45 (45)	33 (4)	60 (12)	65 (69)	57 (20)	42 (56)			
1	27 (27)	58 (7)	15 (3)	26 (28)	34 (12)	31 (41)			
2+	28 (28)	8 (1)	25 (5)	8 (8)	9 (3)	28 (37)			
Missing data	1 (1)	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)			

Note. Infrequent indoor tanning was defined as 1–9 indoor tanning sessions during the past year, whereas frequent indoor tanning was defined as 10 or more tanning sessions during the past year. OCD = obsessive-compulsive disorder.

\*  $p < .05$ .

\*\*  $p < .01$ .