Objective: To better understand the complex motivations involved with UV light (UVL) tanning behavior.

Design: Two written instruments, the CAGE (Cut down, Annoyed, Guilty, Eye-opener) Questionnaire, used to screen for alcohol abuse or dependence, and the American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) criteria for substance-related disorders, were modified to evaluate subjects for a substance-related disorder involving UVL tanning.

Setting: Galveston Island beach.

Subjects: A total of 145 beachgoers.

Main Outcome Measures: Positive findings from the 2 evaluation instruments.

Results: Of the 145 subjects, 38 (26%) met the modified CAGE criteria, and 77 (53%) met the modified DSM-IV-TR diagnostic criteria for a substance-related disorder with regard to UVL and related sun tanning. The results from both instruments were significantly associated (P = .03).

Conclusions: Individuals who chronically and repetitively expose themselves to UVL to tan may have a novel type of UVL substance-related disorder.

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Subject demographic data are summarized in Table 1. Of the 145 beachgoers interviewed, 38 (26%) met mCAGE criteria and 77 (53%) met mDSM-IV-TR criteria. The mCAGE and mDSM-IV-TR results were significantly associated (P =.03) (Table 2). Findings of the mDSM-IV-TR were not significantly associated with any of the 3 demographic factors (P =.19-.57). Although not statistically significant, almost twice as many women as men had positive mCAGE responses (31% vs 17%; P =.08), and more subjects with higher Fitzpatrick skin types (III, IV, or V) than those with lower types (I or II) had positive mCAGE responses (29%-33% vs 0%; P =.07). Positive mDSM-IV-TR subjects were 2.2 times more likely than negative mDSM-IV-TR subjects to go to the beach to get a tan (P =.05, controlling for other 4 factors). Although not statistically significant, positive mCAGE subjects were also 2.2 times more likely than negative mCAGE subjects to go to the beach to get a tan (P =.08). In addition, women were 5.5 times more likely than men (P <.001), and young people (age 18-25 years) were 3.1 times more likely than older people (age ≥36 years) (P =.04) to go to the beach to get a tan. The outcomes of the other 4 reasons to go to the beach and number of sun protections were not significantly related to mDSM-IV-TR or mCAGE responses, controlling for the other factors. Posi-

### Table 1. Demographic Characteristics of Study Subjects

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%) of Subjects (N = 145)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td></td>
</tr>
<tr>
<td>&lt;18</td>
<td>3 (2)</td>
</tr>
<tr>
<td>18-25</td>
<td>70 (48)</td>
</tr>
<tr>
<td>26-35</td>
<td>40 (28)</td>
</tr>
<tr>
<td>36-45</td>
<td>12 (8)</td>
</tr>
<tr>
<td>45-53</td>
<td>4 (3)</td>
</tr>
<tr>
<td>Fitzpatrick skin type</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>1 (1)</td>
</tr>
<tr>
<td>II</td>
<td>16 (11)</td>
</tr>
<tr>
<td>III</td>
<td>66 (46)</td>
</tr>
<tr>
<td>IV</td>
<td>50 (35)</td>
</tr>
<tr>
<td>V</td>
<td>12 (8)</td>
</tr>
</tbody>
</table>

### Table 2. Association Between mCAGE and mDSM-IV-TR Findings

<table>
<thead>
<tr>
<th>mDSM-IV-TR</th>
<th>mCAGE Negative</th>
<th>mCAGE Positive</th>
<th>Total, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>56</td>
<td>51</td>
<td>107 (74)</td>
</tr>
<tr>
<td>Positive</td>
<td>12</td>
<td>26</td>
<td>38 (26)</td>
</tr>
<tr>
<td>Total</td>
<td>68 (47)</td>
<td>77 (53)</td>
<td>145 (100)</td>
</tr>
</tbody>
</table>

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

**RESULTS**

Associations between mCAGE and mDSM-IV-TR and also between mCAGE or mDSM-IV-TR and each demographic factor (sex, age group, or Fitzpatrick skin type) were assessed using the Pearson χ² test. Age of respondents was categorized as 18 to 25 years, 26 to 35 years, and 36 to 53 years. Relationships between beach-going motivation and explanatory factors (mCAGE, mDSM-IV-TR, and 3 demographic factors) were examined using a logistic regression model. Beach-going motivation was defined as the reasons for going to the beach (to tan, to swim, to relax, to drink, or to improve appearance). The number of days per week desired to tan were dichotomized as 0 or 1 item vs 2 or more items. Number of sun protections were dichotomized as 0 or 1 item vs 2 or more items.

**Figure.** Affirmative responses appear in bold in this sample survey form. (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; mDSM-IV-TR, modified Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision criteria.

**RESULTS**

Subject demographic data are summarized in Table 1. Of the 145 beachgoers interviewed, 38 (26%) met mCAGE criteria and 77 (53%) met mDSM-IV-TR criteria. The mCAGE and mDSM-IV-TR results were significantly associated (P = .03) (Table 2). Findings of the mDSM-IV-TR were not significantly associated with any of the 3 demographic factors (P = .19-.57). Although not statistically significant, almost twice as many women as men had positive mCAGE responses (31% vs 17%; P = .08), and more subjects with higher Fitzpatrick skin types (III, IV, or V) than those with lower types (I or II) had positive mCAGE responses (29%-33% vs 0%; P = .07). Positive mDSM-IV-TR subjects were 2.2 times more likely than negative mDSM-IV-TR subjects to go to the beach to get a tan (P = .05, controlling for other 4 factors). Although not statistically significant, positive mCAGE subjects were also 2.2 times more likely than negative mCAGE subjects to go to the beach to get a tan (P = .08). In addition, women were 5.5 times more likely than men (P < .001), and young people (age 18-25 years) were 3.1 times more likely than older people (age ≥36 years) (P = .04) to go to the beach to get a tan. The outcomes of the other 4 reasons to go to the beach and number of sun protections were not significantly related to mDSM-IV-TR or mCAGE responses, controlling for the other factors. Posi-
tive mDSM-IV-TR subjects were 2.7 times more likely than negative ones to tan 2 or more days weekly ($P = .007$, controlling for the other 4 factors). However, number of days per week to tan was not significantly related to mCAGE or the other factors.

### COMMENT

Numerous studies in a wide range of settings have shown that knowledge about the dangers of UVL often fails to alter tanning behavior. Monfrecola et al\(^7\) showed that although most young people were very aware of the risks associated with sun exposure, they continued to sunbathe. Mawn and Fleisher\(^3\) reported that those using tanning beds knew more about the dangers of long-term UV effects than nonusers. Arthey and Clarke\(^6\) reviewed the psychological literature about tanning and concluded that although many studies found a high level of knowledge about the dangers of excessive sun exposure and the need for sun protection, more knowledge about UVL risks did not often translate into a decreased desire for a tan or altered sun-tanning activity. Robinson et al\(^7\) showed that although teenagers were aware that excessive sun exposure causes skin cancers and sunburns, and that using sunscreen and other sun-protective methods could prevent these consequences, this knowledge did not prevent them from sunburning. Another study by Robinson and colleagues\(^8\) noted that while public knowledge about adverse effects of the sun broadened from 1986 to 1996, sunburning and the regular use of tanning booths increased.

Despite these recognized limitations to UVL tanning education and behavior modification, several other studies have shown that educational interventions may be successful in decreasing UVL exposure. One educational intervention based on appearance was successful in decreasing indoor tanning by female college students.\(^9\) Parental education about the risks of skin cancer prior to sunburn resulted in significantly fewer sunburns and reduced sunburn severity in their children compared with controls.\(^10\) In another study, college students evaluated 1 month following educational intervention with a UV facial photograph and videotape presentation reported stronger sun protection intentions and behavior.\(^11\)

Anecdotal observations about patients who seemed “addicted to the sun” have been discussed in dermatology for years. Ramirez et al\(^12\) recently observed that beachgoers often make additional efforts to tan at other locations if the beach is not available. Our study identified a subset of beachgoers who meet objective criteria for an SRD with respect to UVL tanning. These findings support the experimental observation that UVL tanning behavior is a reinforcing stimulus owing to its physiologic effects.\(^13\) The generation of endogenous endorphins in the skin following exposure to sunlight could reinforce tanning behavior and explain the addictive nature of tanning under some circumstances. While earlier studies found increased levels of endorphins following UVL exposure,\(^14,15\) subsequent studies have not confirmed these findings.\(^16,17\)

Another investigative approach to the endorphin theory of tanning behavior would be to evaluate positron emission tomography brain images of subjects identified by mCAGE and mDSM-IV-TR as possibly having an SRD with respect to UVL tanning. Comparisons of observations following control (sham) vs actual exposure to UVL would be analogous to research approaches used to study other human addictions.\(^18\) The potential SRD nature of UVL tanning behavior might explain why some educational efforts that focused exclusively on the long-term health effects of tanning have not had strong success.

The recognition of UVL tanning as a potential SRD has implications for future strategies to prevent and decrease UVL tanning. While education has long been used to inform individuals about the dangers of chronic and repetitive UVL exposure, it would seem likely that additional measures would be needed for that subset of the population who meet the criteria for UVL tanning SRD. The harmful effects of cumulative UVL exposure on the skin have been the major rationale for governmental restriction of indoor tanning in many jurisdictions, but this regulatory response does not always translate into reduced usage. Beasley and Kittel\(^19\) found that almost half of study participants responded that indoor tanning regulations would not change their tanning behavior. Nonetheless, legal restrictions for other substances with associated health risks such as tobacco products and alcoholic beverages are widely used governmental strategies to restrict access by underage populations. It is possible that a similar strategy could be adopted to successfully curtail the use of indoor tanning facilities by children and teenagers if enough resources for enforcement were made available. Indoor tanning regulations in Texas prohibit use by children younger than 13 years under most circumstances.\(^20\) Other states have also set minimum ages for tanning salon use.\(^21\) Illinois prohibits the use of indoor tanning facilities by persons younger than 14 years, as does California; and Wisconsin sets the age limit at 16 years.\(^22\) However, even if the issue of indoor UVL exposure is successfully addressed, the successful regulation of outdoor tanning with natural sunlight, a major source of UV exposure, would remain problematic.

This initial cross-sectional study of a highly selected population (beachgoers) may not be generalizable to the general population. Future studies should be designed to validate these mCAGE and mDSM-IV-TR findings in larger populations, including nonbeachgoers. It would also be interesting to study the mCAGE and mDSM-IV-TR in populations using indoor tanning facilities and in those with other known SRDs.

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Previous Presentation: This research was presented in part as a poster at the American Academy of Dermatology Summer Meeting; July 26-28, 2003; Chicago, Ill.
REFERENCES


20. Texas Health and Safety Code; Chapter 145 (Tanning Facilities); Section 145.008 (f) (g); 2001. Available at: www.capitol.state.tx.us/statutes/statutes.html.


News and Notes

The First World Congress on Teledermatology will be held in Graz, Austria, from November 9 to 11, 2006; sponsored by the International Society of Teledermatology and the Department of Dermatology, Medical University, Graz. Contact Cesare Massone, MD, Congress Secretary, Department of Dermatology, Medical University of Graz, Auenbruggerplatz 8, A-8036 Graz, Austria (cesare.massone@derma.at) for more information. Updated information concerning the congress will be presented on the conference Web site at www.teledermatology-society.org/worldcongress.