

Shedding Light at the Tanning Parlor: A Review of the Recent Research on Teenage Tanning Behavior

Patricia M. Federczyk, BS; J. Daniel Jensen, BS; Robert P. Dellavalle, MD, PhD, MSPH

The past 20 years have brought increased public awareness to the link between UV radiation and skin cancer. Recently, the International Agency for Research on Cancer, a division of the World Health Organization, raised tanning beds to category 1 carcinogenicity, the highest cancer risk category defined by the agency and the same category as cigarettes. Despite growing public awareness of the dangers related to UV radiation exposure, the incidence of skin cancer and use of indoor tanning beds continues to rise. Despite skin cancer being ranked as the most common form of cancer in the United States, the indoor tanning industry has grown substantially, generating annual revenues of \$5 billion. This article reviews the growth and practices of the indoor tanning industry, the factors that motivate adolescents to tan, and the effectiveness of various public health interventions, and increased regulation of the indoor tanning industry in changing the tanning behaviors of the adolescent population.

In 2009, the American Cancer Society estimated that there were over one million cases of cutaneous malignancy in the United States, making skin cancer the most common human neoplasm.¹ The prevalence of skin cancer alone results in an enormous human and fiscal cost. There were approximately 70,000 cases of malignant melanoma in the United States, causing almost 9000 deaths in 2009. Additionally, while

the mortality from nonmelanoma skin cancers, including basal and squamous cell carcinomas, is relatively low, nonmelanoma skin cancers have been estimated to be a greater cost to public health than any other type of cancer.² There are various causes of skin cancer, whether from exposure to sun or indoor tanning beds, with UV radiation being one of the most well known and well understood of these causes.

Indoor tanning beds primarily use UVA radiation to stimulate melanogenesis and induce tanning of the skin. There is a relative paucity of UVB rays in tanning bed radiation when compared to natural solar radiation, which leads many individuals who use indoor tanning beds to believe that there is a decrease in health risks associated with indoor tanning compared to sun exposure. However, there is growing evidence that implicates both UVA and UVB radiation as the primary causes of skin cancers.³ A recent systematic review of the literature

Ms. Federczyk and Mr. Jensen are from the Department of Dermatology, University of Colorado Denver, Aurora. Dr. Dellavalle is from the Denver Veterans Affairs Medical Center, Colorado, and the Colorado School of Public Health, Epidemiology, Aurora.

The authors report no conflict of interest in relation to this article.

Correspondence: Robert P. Dellavalle, MD, PhD, MSPH, Department of Veteran Affairs Medical Center, 1055 Clermont St, Box 165, Denver, CO 80220 (robert.dellavalle@ucdenver.edu).

showed that individuals who overused tanning beds before age 35 years had a higher risk for cutaneous and ocular melanomas as well a higher risk of squamous cell carcinoma.⁴ In addition to higher melanoma and squamous cell carcinoma risks, another study also found an increased risk of basal cell carcinoma among individuals who used indoor tanning beds.⁵

The safety of indoor tanning has been a hot issue of debate for many years. In 1979, the US Food and Drug Administration (FDA) designated indoor tanning beds as regulated medical devices and mandated that tanning beds be equipped with exposure timers. Further recommendations were given in 1985 regarding the scheduling of indoor tanning bed–derived UV dosages that would reduce the incidence of sunburn. Since then, self-reported adverse event data have been recorded. A recent analysis of these data indicated that of all adverse events from indoor tanning bed use reported between 1985 and 2006, 50% were direct results of exposure to UV radiation. Furthermore, 36% of the UV-related injuries were due to noncompliance with FDA recommendations.⁶ However, these data were not intended for the measurement of adverse outcomes and likely underestimated the number of indoor tanning bed users who experienced adverse outcomes.⁷ In July of 2009, the International Agency for Research on Cancer reclassified the UV radiation from tanning beds from “possibly carcinogenic” to “carcinogenic to humans,” the highest of such classifications.⁸ This placed exposure to UV radiation from indoor tanning beds on par with UV radiation from sun exposure, which had received the same designation only a few years earlier.

THE INDOOR TANNING INDUSTRY

Each year in the United States the indoor tanning industry generates \$5 billion in revenue, a remarkable increase from \$1 billion earned back in 1992.^{9,10} Ten percent of the US population, or approximately 30 million customers, use indoor tanning facilities annually.¹¹ Three million customers per day visit tanning facilities, and there are between 25,000 and 50,000 facilities employing 160,000 workers.^{6,10,12,13} The average number of indoor tanning facilities exceeds the number of Starbucks or McDonald’s restaurants in the largest US cities.¹⁴ The rapid rise in the popularity of indoor tanning also is evident worldwide. In the United Kingdom, more than 3 million citizens, or 5% of the population, use indoor tanning facilities with one in 5 customers paying for more than 100 tanning sessions per year.¹⁵ From 1992 to 2006, the number of tanning salons in New Zealand drastically increased by 241%, while the number of indoor tanning device wholesalers increased by 525%.¹⁶

Higher rates of indoor tanning occur in young white women.¹⁷ Approximately 70% of the US customer base is composed of white women between the ages of 16 and 49 years.¹⁸ One study demonstrated that 20% of adults aged 18 to 29 years and 11% of adolescents and young adults aged 11 to 18 years used indoor tanning facilities. The rate of indoor tanning bed use is even higher among female college students, reaching as high as 40%.¹¹ Approximately 2.9 million adolescents between the ages of 13 and 19 years have used an indoor tanning facility and more than 28% of white adolescent girls admitted to using indoor tanning facilities 3 or more times in their lives.^{19,20} Despite a variety of public health advertisements that warn the public about the adverse effects of tanning, the number of individuals who use indoor tanning beds continues to increase. From 1988 to 2007, the percentage of young adults using indoor tanning facilities increased from 1% to 27%.²¹

One reason for the continued success of the indoor tanning industry is its ability to make non–evidence-based claims that downplay the risks of exposure to UV radiation. The Smart Tan Network, a lobby group for the tanning industry,¹⁷ and the Indoor Tanning Association Web sites include links to various sites that support indoor tanning, such as the Vitamin D Council and TanningTruth.com. Statements made by proponents of the indoor tanning industry reveal a lack of concern and denial over the harmful effects of exposure to UV radiation. Table 1 summarizes the common false claims made by the indoor tanning industry and the counterclaims supported by research and medical literature.^{17,21,10,22-27}

Efforts also have been made to target the adolescent population, who are at the most risk for developing the long-term risks from exposure to UV radiation. A study that investigated the advertisements in Denver-area public high school newspapers revealed that 48% of high schools had indoor tanning facility advertisements in their newspapers. Of the contents contained within the indoor tanning facility advertisements, 48% offered discounts and 38% offered unlimited tanning for periods as long as 4 months. Only 5% of the advertisements mentioned the need for parental accompaniment or consent, and only 3% of advertisements included an age restriction.²⁸

FACTORS BEHIND ADOLESCENT TANNING BEHAVIORS

Several recent studies have examined the indoor tanning behavior of adolescents and young adults in the United States and in other parts of the world.^{17,29-32} One Danish study showed that almost 60% of women aged 15 to 19 years used an indoor tanning bed within the

TABLE 1

Misleading Tanning Industry Claims and Research-Based Counterclaims

Indoor Tanning Industry Claims

Indoor tanning offers skin a natural protection against sunburns, and developing a “base tan” is recommended before going on sunny vacations or engaging in outdoor summer activities.¹⁰

Indoor tanning is safer than outdoor tanning as it minimizes the risk for sunburn.²¹

Regular tanning is necessary to achieve adequate daily vitamin D levels. The use of supplements is “impractical” and “unnatural.”²³

No studies demonstrate the link between melanoma and exposure to UV radiation from indoor tanning beds.²¹

Research-Supported Rebuttals

The degree of sun protection offered by a tan is similar to wearing a sunscreen with only an SPF of 3 to 4.²²

Sunburns still occur in 18% to 55% of individuals who use indoor tanning beds.¹⁷

Only 5 to 10 minutes of sun exposure to the face, hands, and arms 2 to 3 times a week during the summer months is enough to achieve high vitamin D levels.²⁴ Adequate vitamin D levels also can be obtained by consuming oily fish, dairy products, fortified juices and cereals, and over-the-counter supplements.²⁵

The IARC and WHO classified UVA and UVB radiation as carcinogens. Two reviews have demonstrated that users of indoor tanning beds have a higher risk for melanoma than nonusers.^{26,27} The risk for melanoma increases by 75% for frequent indoor tanning bed users who use an indoor tanning bed for the first time before age 35 years.²⁶

Abbreviations: SPF, sun protection factor; IARC, International Agency for Research on Cancer; WHO, World Health Organization.

previous year despite being generally more aware of the relationship between exposure to UV radiation and skin cancer than their older female counterparts.²⁹ Decisions underlying tanning behavior are affected by a diversity of factors and not just health concerns. Cultural, social, and educational issues all play a role in the decision making surrounding tanning behaviors. A growing body of evidence also may indicate that for some, there may be a physiological drive, or addiction, which influences tanning behavior.^{46,47}

One of the strongest factors influencing tanning behavior is peer-crowd identification. Not only is tanning behavior predictive of socialization with peers who have similar beliefs regarding tanning, but tanning behavior also is correlated with specific types of peer groups.^{33,34} A study of undergraduate students at a large American university found that students who identified with the “popular” peer crowd were more likely to use indoor

tanning beds, while those who identified with the “brain” peer crowd were less likely to use indoor tanning beds.³⁵ Approximately 65% to 70% of college students in fraternities and sororities reported using indoor tanning beds during high school and/or college.³⁶ Furthermore, the westernization of Asian Americans in the United States as determined by generation, location raised, or self-rated acculturation has become a form of cultural peer-crowd identification and is associated with attitudes and behaviors that promote sun exposure and a tanned appearance.³⁷ Parental behavior and attitudes with regard to tanning also have been shown to be predictive of the tanning behavior of teenagers,³⁰ indicating that the influence of peer-crowd identification may not be derived just from a close circle of friends, but also from family, role models, mentors, celebrities, and other individuals.

Pressures to achieve a glowing tan are undeniably present. Young women, in particular, are frequently assailed

with images of tanned models in the media. In popular women's magazines in Australia, for example, the targeting of young women is especially evident in young female models who are more likely to be portrayed with darker tans and with more of their body exposed than older women.³⁸ Furthermore, women portrayed in outdoor settings did not wear hats (89%) and generally were not photographed in shade (87%). Depictions of risky tanning behaviors in the media such as these may indirectly translate into other risky behaviors. For example, indoor tanning bed use is positively correlated with risky behaviors among young adults, such as alcohol consumption, drug use, eating disorders, and smoking.^{14,39-41}

Fortunately, public awareness of the link between skin cancer and tanning has become more widespread over the last 20 years.²³ However, this knowledge has not necessarily become a determinant of health behavior.⁴² For example, a tanned appearance has been shown to be generally associated with health and beauty,⁴³ and the prevalence of this cultural perception has steadily increased since 1994.³⁸ This trend was particularly evident in a recent study that analyzed video content on the popular Internet Web site YouTube.com. Of the 72 user-posted videos analyzed, 68% had an overall protanning position and 96% cited a more attractive appearance as a reason to tan.⁴⁴ Only 8 of the 72 videos mentioned skin cancer as potential sequela of tanning. Furthermore, Ezzedine et al⁴⁰ highlighted the disconnect between health awareness and behavior when they recently concluded that indoor tanning bed users seem to be unconcerned with the risks of skin cancer and photoaging. Surprisingly, knowledge of health risks does not seem to be a primary factor underlying tanning behavior.⁴⁵ In addition to the social pressures that promote indoor tanning behavior among teenagers, growing evidence suggests that there may be a physiologic drive or addiction to tanning.⁴⁶ In fact, tanning addiction, or "tanorexia" as it is colloquially known, has been shown to meet *Diagnostic and Statistical Manual of Mental Disorders* criteria for a substance-related disorder.⁴⁷ That tanning is an addiction is further suggested by an increasingly well-informed population that continues to tan despite the known health risks. Tanning dependence has been shown to be predicted by race, higher incidence of indoor and outdoor tanning and burning, lower levels of skin protective behaviors, increased frequency of smoking, and lower body mass index.⁴⁸ The mechanism behind tanning addiction seems to be related to UV radiation-induced activation of tumor suppressor protein p53 to stimulate transcription of pro-opiomelanocortin,⁴⁹ which leads to increased levels of endogenous β -endorphins.⁵⁰ This theory also is

supported by a study, which showed naltrexone therapy in frequent tanners resulted in the development of withdrawal symptoms.⁵¹

TANNING INTERVENTIONS

Multiple nonpolicy interventions have been investigated to promote tanning safety. Appearance-focused interventions that generally include UV photographs of skin damage have been shown to be effective in decreasing indoor tanning bed use and intentions to use indoor tanning devices while promoting sun safety.⁵²⁻⁵⁷ Appearance-based interventions also have been shown to promote sunscreen use in the teenage population.⁵⁸ A recent randomized controlled trial that included 430 women using indoor tanning beds further supports appearance-focused intervention. Participants who read an appearance-focused booklet demonstrated decreased springtime indoor tanning by over 35% with similar decreases in intentions to use indoor tanning beds at 6 months follow-up.⁵⁹

Other interventions to decrease indoor tanning also have been undertaken; however, not all have been successful. Peer-motivational interviewing decreased tanning frequency by an average of 63% using a one-on-one 30-minute counseling session tailored specifically to curb tanning frequency among college-aged women.⁶⁰ However, another arm of the same study showed that nonpictorial handouts, which summarized the risks for skin cancer and showed comparative data about personal tanning habits, were an ineffective intervention when used alone.⁶⁰ These interventions should be presumed to be similarly ineffective in a teenage population.

INDUSTRY REGULATIONS

The indoor tanning industry in the United States is regulated by the FDA, the Federal Trade Commission, and state laws. US Food and Drug Administration regulations address issues regarding posting of warning labels, adhering to maximum exposure schedules, providing protective eyewear, and meeting certain product specifications.⁶¹ The Federal Trade Commission regulates advertising claims made by the indoor tanning industry and prohibits the use of false or deceptive statements. State laws regulate the practice of indoor tanning facilities and their operators. The World Health Organization, the American Medical Association, and the American Academy of Dermatology support passing legislation that bans the use of indoor tanning beds by individuals younger than 18 years.¹⁹ Childhood and adolescence are the most vulnerable periods to the long-term damaging effects of UV exposure and increased skin cancer risk.¹⁹ Despite the rising incidence of skin cancer and the reclassification of UV radiation as carcinogenic to humans, only 8 of the

TABLE 2

Indoor Tanning Age Restriction Regulations in the United States⁶²

Type of Regulation for Minors	States With Regulations
Minimum age restriction	California, Illinois, New Hampshire, New Jersey, New York, North Carolina, Texas, Wisconsin
Parental consent required	Alabama (Jefferson County), Arizona, California, Connecticut, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maine, Maryland (Montgomery County), Massachusetts, Michigan, Minnesota, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oregon, Rhode Island, South Carolina, Tennessee, Texas, Utah (Salt Lake and Utah Counties)
Parental accompaniment required	Alabama (Jefferson County), Florida, Indiana, Kentucky, Louisiana, Maryland (Montgomery County), Massachusetts, Michigan, New Hampshire, New York (Nassau and Suffolk Counties), Tennessee, Texas

28 states with laws that limit the access of minors to indoor tanning beds have age restrictions, with minimum age cut-offs ranging from 13 to 16 years.⁶² The prevalence of indoor tanning bed use by adolescents stayed the same or decreased from 1998 to 2004 in states that had age restriction legislation, whereas rates increased in states without such laws.³⁰ Table 2 lists the states within the United States and the types of regulations that limit indoor tanning use for minors.⁶² Worldwide, only France, New Brunswick in Canada, and the Australian states of South Australia, Western Australia, and Victoria have banned the use of indoor tanning beds for all individuals younger than 18 years.^{63,64} According to the American Medical Association, 3 steps are necessary to adequately regulate the indoor tanning industry in the United States: (1) ban the use of indoor tanning beds by all individuals younger than 18 years; (2) the FDA should conduct hearings to weigh-in on the risk and need for increased regulation; and (3) indoor tanning beds should come with a warning statement by the surgeon general.⁶⁵

Many have looked to current tobacco laws as a model for regulating the indoor tanning industry. Laws prohibiting the sale of tobacco to minors have reportedly attributed to a 40% decrease in the rate of teenage smoking.⁶⁶ It is believed that similar bans on indoor tanning for minors will be more successful due to the lack of nonvendor

sources for obtaining access to indoor tanning beds, the increase in interaction between vendor and buyer that results in greater exposure to law enforcement, and the existence of professional vendor organizations within the indoor tanning industry.⁶³ The reasons used to support increased regulation of the indoor tanning industry parallel the reasons used for banning the sale of tobacco to minors. Tobacco use and tanning are similar because both tobacco and UV radiation are classified as carcinogens, initiation at a young age is predictive of long-term use, and both the tobacco and indoor tanning industries have neglected the best interests of their consumers by denying the negative health effects of their products and encouraging use by minors.^{63,66}

In spite of increased regulation of the indoor tanning industry, problems regarding noncompliance to regulations and lack of adequate enforcement remain. Although Minnesota and Massachusetts both have laws that require parental consent for individuals younger than 16 and 18 years, respectively, a study revealed that 81% of 200 indoor tanning facilities frequented by 15-year-old customers in Minnesota and Massachusetts sold at least one indoor tanning session out of 2 attempts without parental consent.⁶⁷ However, in the presence of non-compliance, states with laws are more likely to require parental consent or accompaniment for minors.⁶⁴

The practices of 3647 US indoor tanning facilities representative of all 50 US states were assessed after telephone contact was made by data collectors posing as 15-year-old white females. Of the facilities located in states with regulations that require parental consent for minors 93% of the facilities mentioned the requirement to the customer compared to 78% of the facilities located in states without the requirement.⁶⁴ Similarly, 43% of facilities in states that require parental accompaniment mentioned the requirement compared to only 10% of facilities located in states without the requirement. A telephone survey of indoor tanning facilities in Texas, Illinois, Wisconsin, and Colorado revealed that states with stricter laws have higher rates of compliance.⁶⁸ The age limits for use of indoor tanning facilities in Texas, Illinois, and Wisconsin are 13, 14, and 16 years, respectively, and Colorado does not have an age restriction. When contacted by a 12-year-old customer, 23% of the facilities in Texas, 74% in Illinois, 89% in Wisconsin, and 18% in Colorado did not sell a tanning session.⁶⁸ Although the presence of stricter laws may increase compliance, there still remains a substantial portion of facilities that do not adhere to the laws, which raises questions regarding the adequacy of enforcement. In states with indoor tanning regulations, one study found that less than half of the cities in each of the 28 states gave citations to indoor tanning facilities that violated the law, one-third of the cities did not perform inspections, and another one-third of the cities performed inspections less than once a year.⁶⁹

Regulatory policies against indoor tanning facilities, such as imposing age restrictions, requiring parental consent or accompaniment for minors, prohibiting advertising to the youth, or implementing stricter government safety standards are directed towards changing business practices and not the attitudes of adolescents towards tanning. The other downside is that these policies require strong government support and adequate funding of law enforcement to ensure compliance. Policies directed towards changing adolescent behavior include promoting media campaigns against tanning and increasing the cost of tanning sessions through taxation. Media campaigns are expensive and require consistent funding, which can be supported by the revenue generated from taxation.⁶⁵ The effectiveness of taxation in reducing the demand for a carcinogen has been demonstrated with the tobacco tax.⁷⁰ Similarly, a new tax on indoor tanning sessions may substantially reduce the demand for the service among adolescents due to their financial constraints and increased price sensitivity.

COMMENT

Indoor tanning bed use among adolescents is not only a public health issue but a cultural and legal concern as well. Despite the increasingly well-supported link between exposure to UV radiation and adverse effects on the skin, tanning frequency among adolescents has stayed steady or increased over the past several decades. While a cultural perception that tanned skin represents health and vitality is increasingly prevalent in the media, efforts should be made by the medical community to discourage risky UV radiation exposure practices, such as indoor tanning bed use among adolescents. Appearance-focused interventions in combination with increased regulation may be an effective means to this end.

REFERENCES

1. Cancer Facts and Figures 2009. American Cancer Society Web site. <http://www.cancer.org/downloads/STT/500809web.pdf>. Accessed November 17, 2009.
2. Housman TS, Feldman SR, Williford PM, et al. Skin cancer is among the most costly of all cancers to treat for the Medicare population. *J Am Acad Dermatol*. 2003;48:425-429.
3. Roberts DJ, Hornung CA, Polk HC Jr. Another duel in the sun: weighing the balances between sun protection, tanning beds, and malignant melanoma. *Clin Pediatr (Phila)*. 2009;48:614-622.
4. International Agency for Research on Cancer Working Group on artificial ultraviolet (UV) light and skin cancer. The association of use of sunbeds with cutaneous malignant melanoma and other skin cancers: a systematic review. *Int J Cancer*. 2007;120:1116-1122.
5. Schulman JM, Fisher DE. Indoor ultraviolet tanning and skin cancer: health risks and opportunities. *Curr Opin Oncol*. 2009;21:144-149.
6. Dowdy JC, Sayre RM, Shepherd JG. Indoor tanning injuries: an evaluation of FDA adverse event reporting data. *Photodermatol Photoimmunol Photomed*. 2009;25:216-220.
7. Miller SA, Beer JZ, Savalia V. Commentary on 'Indoor tanning injuries: an evaluation of FDA adverse event reporting data'. *Photodermatol Photoimmunol Photomed*. 2009;25:223-224.
8. El Ghissassi F, Baan R, Straif K, et al. A review of human carcinogens—part D: radiation. *Lancet Oncol*. 2009;10:751-752.
9. Demierre MF. Time for the national legislation of indoor tanning to protect minors. *Arch Dermatol*. 2003;139:520-524.
10. Frequently asked questions. Indoor Tanning Association Web site. <http://www.theita.com/indoor/faq.cfm>. Accessed September 26, 2009.
11. Poorsattar SP, Hornung RL. UV light abuse and high-risk tanning behavior among undergraduate college students. *J Am Acad Dermatol*. 2007;56:375-379.
12. Whitmore SE, Morison WL, Potten CS, et al. Tanning salon exposure and molecular alterations. *J Am Acad Dermatol*. 2001;44:775-780.
13. Kwon HT, Mayer JA, Walker KK, et al. Promotion of frequent tanning sessions by indoor tanning facilities: two studies. *J Am Acad Dermatol*. 2002;46:700-705.
14. Hoerster KD, Garrow RL, Mayer JA, et al. Density of indoor tanning facilities in 116 large U.S. cities. *Am J Prev Med*. 2009;36:243-246.
15. Are you tanorexic? Times Online Web site. http://women.timesonline.co.uk/tol/life_and_style/women/style/article1076671.ece. Published November 14, 2000. Accessed November 27, 2009.

TEENAGE TANNING BEHAVIOR

16. Jopson JA, Reeder AI. An audit of Yellow Pages telephone directory listings of indoor tanning facilities and services in New Zealand, 1992-2006. *Aust N Z J Public Health*. 2008;32:372-377.
17. Heckman CJ, Coups EJ, Manne SL. Prevalence and correlates of indoor tanning among US adults. *J Am Acad Dermatol*. 2008;58:769-780.
18. Levine JA, Sorace M, Spencer J, et al. The indoor UV tanning industry: a review of skin cancer risk, health benefit claims, and regulation. *J Am Acad Dermatol*. 2005;53:1038-1044.
19. Balk SJ, Geller AC. Teenagers and artificial tanning. *Pediatrics*. 2008;121:1040-1042.
20. Demko CA, Borawski EA, Debanne SM, et al. Use of indoor tanning facilities by white adolescents in the United States. *Arch Pediatr Adolesc Med*. 2003;157:854-860.
21. Robinson JK, Kim J, Rosenbaum S, et al. Indoor tanning knowledge, attitudes, and behavior among young adults from 1988-2007. *Arch Dermatol*. 2008;144:484-488.
22. Sivamani RK, Crane LA, Dellavalle RP. The benefits and risks of ultraviolet tanning and its alternatives: the role of prudent sun exposure. *Dermatol Clin*. 2009;29:149-154.
23. Get real! Myths about UV. TanningTruth.Com. http://www.tanningtruth.com/index.php/get_real/. Accessed September 28, 2009.
24. Are there beneficial effects of UV radiation? World Health Organization. <http://www.who.int/uv/faq/uvhealthfac/en/index1.html>. Accessed September 26, 2009.
25. Make vitamin D, not UV, a priority. Skin Cancer Foundation. <http://www.skincancer.org/make-vitamin-d-not-uv-a-priority.html>. Accessed September 28, 2009.
26. International Programme on Chemical Safety (United Nations Environment Programme, International Labour Organisation, World Health Organization). *Environmental Health Criteria 160: Ultraviolet Radiation*. Geneva, Switzerland: World Health Organization, 1994.
27. International Agency for Cancer Research. The association of the use of sunbeds with cutaneous malignant melanoma and other skin cancers: a systematic review. *Int J Cancer*. 2007;120:1116-1122.
28. Freeman S, Francis S, Lundahl K, et al. UV tanning advertisements in high school newspapers. *Arch Dermatol*. 2006;142:460-462.
29. Køster B, Thorgaard C, Clemmensen IH, et al. Sunbed use in the Danish population in 2007: a cross-sectional study. *Prev Med*. 2009;48:288-290.
30. Cokkinides V, Weinstock M, Lazovich D, et al. Indoor tanning use among adolescents in the US, 1998 to 2004. *Cancer*. 2009;115:190-198.
31. Gordon D, Guenther L. Tanning behavior of London-area youth. *J Cutan Med Surg*. 2009;13:22-32.
32. Dissel M, Rotterdam S, Altmeyer P, et al. Indoor tanning in North Rhine-Westphalia Germany: a self-reported survey. *Photodermatol Photoimmunol Photomed*. 2009;25:94-100.
33. Bagdasarov Z, Banerjee S, Greene K, et al. Indoor tanning and problem behavior. *J Am Coll Health*. 2008;56:555-561.
34. Banerjee SC, Greene K, Bagdasarov Z, et al. 'My friends love to tan': examining sensation seeking and the mediating role of association with friends who use tanning beds on tanning bed use intentions. *Health Educ Res*. 2009;24:989-998.
35. Stapleton J, Turrissi R, Hillhouse J. Peer crowd identification and indoor artificial UV tanning behavioral tendencies. *J Health Psychol*. 2008;13:940-945.
36. Dennis LK, Kim Y, Lowe JB. Consistency of reported tanning behaviors and sunburn history among sorority and fraternity students. *Photodermatol Photoimmunol Photomed*. 2008;24:191-198.
37. Gorell E, Lee C, Muñoz C, et al. Adoption of Western culture by Californian Asian Americans: attitudes and practices promoting sun exposure. *Arch Dermatol*. 2009;145:552-556.
38. Dixon H, Dobbins S, Wakefield M, et al. Portrayal of tanning, clothing fashion and shade use in Australian women's magazines, 1987-2005. *Health Educ Res*. 2008;23:791-802.
39. Coups EJ, Manne SL, Heckman CJ. Multiple skin cancer risk behaviors in the U.S. population. *Am J Prev Med*. 2008;34:87-93.
40. Ezzedine K, Malvy D, Mauger E, et al. Artificial and natural ultraviolet radiation exposure: beliefs and behaviour of 7200 French adults. *J Eur Acad Dermatol Venereol*. 2008;22:186-194.
41. O'Riordan DL, Field AE, Geller AC, et al. Frequent tanning bed use, weight concerns, and other health risk behaviors in adolescent females (United States). *Cancer Causes Control*. 2006;17:679-686.
42. Tsunoda K, Masuda K. Fashion victim: Severe tongue burn from a tanning machine. *Burns*. 2009;35:146-147.
43. Hurd CL, Korotchenko A. Older women and suntanning: the negotiation of health and appearance risks. *Sociol Health Illn*. 2009;31:748-761.
44. Hossler EW, Conroy MP. YouTube as a source of information on tanning bed use. *Arch Dermatol*. 2008;144:1395-1396.
45. Heckman CJ, Wilson DB, Ingersoll KS. The influence of appearance, health, and future orientations on tanning behavior. *Am J Health Behav*. 2009;33:238-243.
46. Nolan BV, Feldman SR. Ultraviolet tanning addiction. *Dermatol Clin*. 2009;27:109-112.
47. Nolan BV, Taylor SL, Liguori A, et al. Tanning as an addictive behavior: a literature review. *Photodermatol Photoimmunol Photomed*. 2009;25:12-19.
48. Heckman CJ, Egleston BL, Wilson DB, et al. A preliminary investigation of the predictors of tanning dependence. *Am J Health Behav*. 2008;32:451-464.
49. Cui R, Widlund HR, Feige E, et al. Central role of p53 in the sun-tan response and pathologic hyperpigmentation. *Cell*. 2007;128:853-864.
50. Feldman SR, Liguori A, Kucenic M, et al. Ultraviolet exposure is a reinforcing stimulus in frequent indoor tanners. *J Am Acad Dermatol*. 2004;51:45-51.
51. Kaur M, Liguori A, Lang W, et al. Induction of withdrawal-like symptoms in a small randomized, controlled trial of opioid blockade in frequent tanners. *J Am Acad Dermatol*. 2006;54:709-711.
52. Hillhouse J, Turrissi R. Examination of the efficacy of an appearance focused intervention to reduce UV exposure. *J Behav Med*. 2002;25:395-409.
53. Mahler H, Kulik J, Gibbons F, et al. Effects of appearance-based interventions on sun protection intentions and self-reported behaviors. *Health Psychol*. 2003;22:199-209.
54. Jones J, Leary M. Effects of appearance-based admonitions against sun exposure on tanning intentions in young adults. *Health Psychol*. 1994;13:86-90.
55. Pagoto S, McChargue D, Hines E, et al. Effects of a multicomponent intervention on motivation and sun protection behaviors among Midwestern beachgoers. *Health Psychol*. 2003;22:429-433.
56. Jackson KM, Aiken LS. Evaluation of a multicomponent appearance-based sun-protective intervention for young women: uncovering the mechanisms of program efficacy. *Health Psychol*. 2006;25:34-46.
57. Gibbons FX, Gerrard M, Lane DJ, et al. Using UV photography to reduce use of tanning booths: a test of cognitive mediation. *Health Psychol*. 2005;24:358-363.

58. Olson AL, Gaffney CA, Starr P, et al. The impact of an appearance-based educational intervention on adolescent intention to use sunscreen. *Health Educ Res.* 2008;23:763-769.
59. Hillhouse J, Turrisi R, Stapleton J, et al. A randomized controlled trial of an appearance-focused intervention to prevent skin cancer. *Cancer.* 2008;113:3257-3266.
60. Turrisi R, Mastroleo NR, Stapleton J, et al. A comparison of 2 brief intervention approaches to reduce indoor tanning behavior in young women who indoor tan very frequently. *Arch Dermatol.* 2008;144:1521-1524.
61. Lazovich D, Forster JL. Indoor tanning by adolescents: prevalence, practices and policies. *Eur J Cancer.* 2005;41:20-27.
62. McLaughlin JA, Francis SO, Burkhardt DL. Indoor UV tanning youth access laws: update 2007. *Arch Dermatol.* 2007;143:529-532.
63. Dellavalle RP, Parker ER, Ceronsky N, et al. Youth access laws: in the dark at the tanning parlor? *Arch Dermatol.* 2003;139:443-448.
64. Pichon LC, Mayer JA, Hoerster KD, et al. Youth access to artificial UV radiation exposure: practices of 3647 US indoor tanning facilities. *Arch Dermatol.* 2009;145:997-1002.
65. Resolution: 428 (A-06): Prohibiting the Sale of Tanning Parlor Ultraviolet Rays to Those Under 18 Years of Age, American Medical Association House of Delegates (2006).
66. Loh AY. Note: Are artificial tans the new cigarette? how plaintiffs can use the lessons of tobacco litigation in bringing claims against the indoor tanning industry. *Michigan Law Review.* 2008;107:365-390.
67. Forster JL, Lazovich D, Hickie A, et al. Compliance with restriction on sale of indoor tanning sessions to youth in Minnesota and Massachusetts. *J Am Acad Dermatol.* 2006;55:962-967.
68. Hester EJ, Heilig LE, D'Ambrosia R, et al. Compliance with youth access regulations for indoor UV tanning. *Arch Dermatol.* 2005;141:959-962.
69. Mayer JA, Hoerster KD, Pichon LC, et al. Enforcement of state indoor tanning laws in the United States. *Prev Chronic Dis.* 2008;5. http://www.cdc.gov/pcd/issues/2008/oct/07_0194.htm. Accessed September 19, 2009.
70. Dellavalle RP, Schilling LM, Chen AK. Teenagers in the UV tanning booth? tax the tan. *Arch Pediatr Adolesc Med.* 2003;157:845-846. ■