

# Tanning and Teens: Is Indoor Exposure the Tip of the Iceberg?

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## Abstract

Because of recent state regulations and the reduced availability of free-standing tanning salons, indoor tanning (IT) prevalence is beginning to decline. This may lead to unintended consequences, such as increases in outdoor intentional tanning. We advance a series of research directions to track and intervene to address all forms of intentional tanning. First, we advocate for enforcement of IT regulation and encourage collection of data on tanning salon compliance and alternative IT strategies. Second, we suggest questions about outdoor and IT should be included in national surveys. Third, we need to understand the potentially complex patterns of indoor and outdoor tanning

that may exist among those who tan. Fourth, research examining changing motivations for intentional tanning is needed. Finally, IT intervention studies should include outdoor tanning as an outcome to examine the effect of interventions on these related risk behaviors. These advances will ensure the development of novel interventions to address intentional tanning through multiple routes, and to avoid any unintended negative consequence of IT regulation. The promising downward direction of IT use in the United States should now lead the public health field to sharpen its focus on outdoor tanning. *Cancer Epidemiol Biomarkers Prev*; 26(8); 1170–4. ©2017 AACR.

UV radiation exposure causes skin cancers, including melanoma, the most deadly form of skin cancer (1, 2). Indoor tanning (IT) involves intentional exposure to UV for the express purpose of tanning and is categorized as a class I carcinogen, denoting the harmful nature of tanning and its definitive link to cancer (3). Epidemiologic studies have also shown a clear link between IT and the development of melanoma (4, 5). Reducing the harms of IT is one of five goals outlined in the 2014 US Surgeon General's "Call to Action to Prevent Skin Cancer" (2).

Despite these established harms, IT use has increased precipitously over the past 20 years in teenagers and young adults, especially in females (6–9). For example, by 2009, over a third (37%) of non-Hispanic white high school females reported having tanned indoors, with half (49%) of all non-Hispanic white females who tan reporting frequent use ( $\geq 10$  times in the past 12 months; refs. 7, 8). These rates are now starting to decline (7). In fact, mounting IT regulation since 2012 in young users may be beginning to pay off. Guided by success in regulating underage tobacco use (10), 15 states now prohibit IT in individuals under age 18, and 28 states have instituted parental consent laws, whereby teens are able to tan only with parental consent (11). On December 22, 2015, the FDA issued a proposed national rule with the following restrictions for IT beds and booths: (i) to ban use among individuals younger

than 18 years; (ii) to require prospective users of all ages to sign a risk acknowledgment certification; and (iii) to provide user manuals to customers and tanning facility operators on request (12, 13). As of January 2017, the FDA ultimately did not advance this proposed federal regulation; thus, tanning bed use will continue to be regulated at the state level. We advocate for continued efforts for state passage of underage tanning regulations.

As of 2016, IT rates have started to decline among high school students as well as adults in the United States (6, 7). There are multiple potential reasons for this. It is possible that the recent state regulations on underage IT, the media coverage regarding these regulations, as well as the classification of IT devices as carcinogenic, have actually recently led some stand-alone IT salons to close their doors (19,000 free-standing salons reduced to 9,000, thereby reducing IT availability; ref. 14). The addition of a 10% excise tax on tanning may be tipping the balance toward reduced IT, as well, and with the Affordable Care Act remaining intact, this tax remains in effect (2). Finally, the recent negative framing of IT as harmful may be leading to a concomitant erosion of positive social norms regarding IT (15).

Although undoubtedly this is a positive development, it is important to highlight that IT remains only one vehicle for UV exposure. Intentional outdoor tanning (OT) causes sunburns and skin cancer, including melanoma (1). Across an entire population, OT may engage a broader and more diverse population than does IT. OT can be pursued cost-free during vacations, seasonally, and during recreational and sports activities. The belief that people look better with a tan and reductions in the use of sunscreen increase dramatically between ages 11 and 14, particularly among girls (16). Tanning may be more the norm than the exception among young people in outdoor settings; one study showed that 60% to 80% of teen beach and park users report that they intentionally tan outdoors (17, 18). Only half of teens use sunscreen, and only a

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third do so routinely (19–23), with 83% of teens reporting sunburn in the most recent summer (21). The highest sunburn rates are among girls who believe sunburning is "worth it" to get a good tan (21), indicating that tanning intentions discourage sun protection. In Sweden, 86% of teens ages 17 to 19 report that they tan outdoors (24). However, precise data on OT rates in the United States are lacking. Use of sunscreen has actually decreased in U.S. high school students from 2001 to 2011 (from 68% to 56%, respectively; refs. 19, 25). Sunscreen use may be replaced by other, more efficacious strategies, such as protective clothing use and shade seeking (26). Yet despite these small increases in sun protective behaviors in recent years, sunburn rates have been shown to be stable in the United States, with 50% of all adults reporting at least one sunburn in the past 12 months (27). Given that national U.S. surveys only track IT, one cannot determine how OT might be changing over time, or how changes in IT regulation may be affecting OT.

Furthermore, IT and OT can co-occur. Two studies, one in the United States (28), and one in Sweden (24), show that IT and OT are strongly correlated. In Sweden for example, OT is associated with an increase in the likelihood of IT in both males (1993 OR = 6.68,  $P < 0.001$ ; 1999 OR = 3.45,  $P < 0.001$ ) and females (1993 OR = 4.64,  $P < 0.001$ ; 1999 OR = 3.18,  $P < 0.001$ ). One large study in the United States demonstrated that IT is significantly related to avoiding shade and having more sunburns, although OT per se was not measured (29). High school students who report IT have a higher incidence of recent sunburn compared with those who do not report IT (83% vs. 54%, respectively,  $P < 0.001$ ; ref. 7), and this is true in adults as well (30). Sunbathing is more common among those who indoor tan more frequently (31). Accordingly, it is possible that OT may increase among those who are potential IT users, among those who use IT sporadically, as well as those who alternate use of IT and OT. Some may use IT and OT concurrently as well.

The overarching objective of enhanced IT regulation is to reduce skin cancer and melanoma rates via reductions in exposure to UV among young people, who may arguably be most susceptible to its carcinogenic potential. Yet the promising downward direction of IT use in the United States should not lead the public health field to overlook OT. In contrast, the promising downward direction of IT use in the United States should now lead the public health field to sharpen its focus on OT.

In fact, greater IT regulation and greater awareness of the harms of IT may shift some IT users to greater OT exposure. Reduced availability of IT for underage youth may lead them to identify increasing opportunities to tanning outdoors, especially among those who remain motivated to achieve a tanned look, or to maintain the perceived mood and relaxation benefits of tanning (32). The heightened publicity regarding the harms of IT may lead the public to perceive OT as comparatively safe (15). High school students perceive OT as preferable, as they are "healthier" and more "natural" than tans achieved indoors (33). A similar phenomenon may be operating in the tobacco context as well. Currently, rates of e-cigarettes, which are seen as safer than cigarettes, are on the rise. Cigarette and e-cigarette use is highly correlated (34), and there is developing public health concern that adolescent smokers may be replacing one risk behavior with another (34). Combined with the strong correlation between indoor and OT, it is likely that IT and OT are reciprocal behaviors. Below, we advance a series of research recommendations that

**Table 1.** Summary of recommendations

Recommendation	Rationale
1. Better-enforced IT regulations and collection of data.	New IT regulations infrequently include content on enforcement, and enforcement is rarely measured.
2. Inclusion of OT questions in national surveys.	Data on prevalence and frequency of intentional tanning outdoors are generally not available.
3. Understanding complex patterns of IT and OT.	Little is known about how IT and OT may function concurrently or in alternation.
4. More research is needed on examining changing motivations for IT and OT.	Behavioral research to understand the common and unique motivations for IT and OT, respectively, will improve public health messaging in reducing intentional tanning.
5. IT intervention studies should include OT as a secondary outcome.	IT intervention studies should routinely consider OT to increase our holistic understanding of intentional tanning through multiple routes.

require immediate attention to this end (see Table 1 for a summary).

### Recommendation 1: Better-Enforced IT Regulations and Collection of Data

New IT regulations infrequently include language on enforcement. Studies have shown that not all tanning salons are complying with regulations, and not all states are adequately enforcing these regulations (13). Research must monitor industry perceptions of enforcement but seek to conduct interviews of underage consumers who attempt to indoor tan, both in tanning salons as well as contexts much more difficult to regulate, including gyms and spas. Definitions of "tanning facilities" vary by state, but are often defined as "any place where a tanning device is used for a fee, membership, or any other compensation," including gyms, spas, or apartment buildings that provide access to tanning equipment, whether or not a fee is charged (35). In addition, consideration of under-19-year-old tanning regulations should be considered (36). Laws to limit minors' access to tanning parlors should be considered in the same way as laws that limit youth access to tobacco (37, 38). Every state prohibits the purchase of tobacco products by those younger than 18 years old and some prohibit sales to those under 19 years old (37). Under-19-year-old laws have the benefit of keeping all exposure out of high schools, where 18-year-olds could potentially increase IT behavior in their young peers. Tanning and tobacco are carcinogenic and both are preventable exposures; therefore, governments should act to protect young people from these known carcinogens (36). We must continue to advocate for better and better-regulated legislation around the restriction of IT.

### Recommendation 2: Inclusion of OT Questions in National Surveys

Second, U.S. national survey efforts, such as the Youth Risk Behavior Survey (YRBS), have remarkably not collected data on intentional OT, making it difficult to track the problem of intentional OT. Although some large national studies measure sun protection, such as shade seeking, using sunscreen,

wearing long sleeves, etc., on the state level (39), or on the national level (40), no large studies regularly measure intentional OT. We recommend that a more careful tracking of both forms of intentional tanning associated with UV exposure, both IT and OT, be conducted on nationally representative samples of teenagers and young adults, and specifically for the inclusion of OT in the YRBS, National Longitudinal Study of Adolescent to Adult Health, and the National Longitudinal Survey of Youth 1979 (41). Such items may include seeking outdoor exposure or avoiding sun protection strategies to achieve a tan. In a systematic review of intentional tanning among adolescents in the United States (42), almost all studies (12/14) presented data on adolescent IT but not OT; one study presented data on both IT and sunbathing among adolescent males (43), and one study reported data on whether participants "try to get a tan" (44). Inclusion of OT in national surveys and other population-based studies will allow us to track whether reductions in IT, which will hopefully continue, are resulting in increases in OT as a consequence. These new questions could be piloted first in a few states. However, in the absence of targeted campaigns to counter the positive perception of appearing tan, it is unlikely that it will result in a reduction of OT. Campaigns in Australia have led to a reduced perception of the value of tanned skin that ultimately resulted in reduced OT (45, 46). Given this successful example, a U.S. public health effort to directly combat social norms about the beauty of tanned skin, emphasizing the attractiveness of all natural skin tones, would hold promise in reducing all forms of intentional tanning, as well as sunburning, in the United States.

### **Recommendation 3: Understanding Complex Patterns of IT and OT**

Third, we need to understand the potentially complex patterns of use of IT and OT, including conjoint use. Studies have shown that people may alternate sources of tanning by climate and season of the year, tanning outdoors in the summer and indoors in the winter (31), indicating that those who prefer a tan may be utilizing all means possible to tan year round. Use of IT may serve as "preparation" for sunny holidays (47). Studies also indicate that sunburns are very frequent in the United States (48); OT may be an important motive that leads to getting sunburned. We advocate for research examining how broad, diverse groups of young people might make discrete choices about IT versus OT, based on availability, social norms, culture, perceived risk, or other relevant factors. These advances would be helpful in developing novel interventions to address intentional tanning broadly, rather than keeping the spotlight on only the best understood of these behaviors, namely IT. It will be important to document, in descriptive and longitudinal research, how these patterns and individual trajectories may shift over time as IT decreases, and whether there are upturns in sunburn rates and even rates of new skin cancers that may be associated with increased OT as well. Incidental tanning, tans achieved without specific tanning goals, may have similar or distinct motivations and prevalence compared with intentional tanning. Importantly, as IT decreases, trajectories for OT, both intentional and unintentional, are currently completely unknown and require further study.

### **Recommendation 4: More Research Is Needed on Examining Changing Motivations for IT and OT**

Fourth, with recent reductions in IT, we need to understand whether important predictors of IT are decreasing as well, including beliefs that tanned skin is more attractive, among other motivations for tanning. In fact, the social norms around IT and OT may differ and may change over time. Examination of factors related to availability of OT, including geographical differences, beach access, and frequency of winter sun vacations, may help explain rates and preferences for OT. Indeed, if these motivations are also on the decrease, it may be more plausible that we can rely on reductions in IT to actually reduce skin cancer rates, including melanoma. If motivations for tanning remain high, then other approaches to addressing intentional tanning will need to be sought. Public health messaging around the health benefits of vitamin D may also be encouraging higher levels of intentional tanning, both indoor and outdoor, and reduced sun protection, compounding public beliefs around the health benefits of being out in the sun. In fact most individuals receive sufficient vitamin D from diet, supplements, as well as incidental sun exposure, and those at higher skin cancer risk (based on lighter skin phenotype) are particularly efficient at converting low levels of UVB to vitamin D. This is because vitamin D synthesis and production require very little sun exposure, with most individuals easily getting enough vitamin D using adequate sun protection. Those unable to make vitamin D effectively from sun include darkly pigmented individuals and the elderly (49, 50).

### **Recommendation 5: IT Intervention Studies Should Include OT As a Secondary Outcome**

Finally, intervention studies addressing IT specifically should include changes in OT as at least a secondary outcome of intervention. This will allow us to develop a robust knowledge base concerning any iatrogenic increase in OT in those who may be encouraged to reduce or eliminate their tan seeking through tanning salons, as well as intervention components that may be most successful in leading to cessation of all types of intentional tanning, rather than only IT, specifically.

### **Concluding Remarks**

In summary, we join others (51, 52) in calling for heightened focus on skin cancer prevention research given increasing rates of melanoma in the United States (1), especially among young people (1, 9). More specifically, we advocate for research to understand the behavioral and attitudinal impact of IT regulation, and recent reductions in IT in the United States. While we hope to see reductions in IT continue over time, especially in adolescent girls and young women who have traditionally been the heaviest users of IT, we should be able to document how this might be affecting other tanning strategies that may be adopted, as well as the beliefs and contexts that may promote or inhibit OT. Ideally, the ability to examine the role of all types of tanning on disease outcomes will also become possible. Given the timing of increased barriers to IT, now is the ideal time to enhance our efforts to understand, and ultimately address, all forms of intentional tanning, and to broaden our focus beyond those who

engage in IT, to those who may be willing or receptive to OT, across the general population.

### Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

### Authors' Contributions

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