



Published in final edited form as:

Ped Health. 2009 December 1; 3(6): 565–578. doi:10.2217/phe.09.55.

Adolescent attitudes towards tanning: does age matter?

Leslie K. Dennis,

Department of Epidemiology, College of Public Health, University of Iowa, Iowa City, IA, USA

Vijaya Kancherla, and

Department of Epidemiology, College of Public Health, University of Iowa, Iowa City, IA, USA

Linda G Snetselaar

Departments of Epidemiology & Community and Behavioral Health, College of Public Health, University of Iowa, Iowa City, IA, USA

Abstract

Adolescents seem to be obsessed with tanning. One third of both adolescents and adults report sunbathing. On average, about 20% of adolescents report ever-using of artificial UV tanning devices with 15% currently using them. Tanning attitudes appear similar for adolescents and adults. The top three reasons for tanning included beliefs that a tan makes them more comfortable socializing with friends, looks better and is attractive. The top reason for using artificial UV tanning devices is also aesthetics, followed by relaxation. Other reasons for using artificial UV tanning devices include vacation preparation and to gain a protective base. Attitudes related to appearance that result in more frequent tanning may be difficult to change.

Keywords

adolescent; attitudes; behavior; public health; skin cancer (skin neoplasms); tanning; ultraviolet rays

Various reports suggest that adolescents seem to be obsessed with tanning [1]. A recent article in *Time Magazine* described tanning practices (via the sun and artificial devices) of an adolescent case report of melanoma [2]. Their articles was sparked by a study [3] that examined whether or not tanning salons allowed 15-year-olds to use their artificial UV tanning devices. The adolescent with melanoma described in *Time* believes regular tanning caused her melanoma and that “the vast majority of scientific literature supports her theory” [2]. This review is not aimed at verifying or refuting such claims, but instead focuses on adolescent attitudes towards tanning and also examines parental or adult attitudes.

Skin cancer is a major public health issue [4]. The major etiological factor associated with skin cancer, both non-melanoma (basal and squamous cell) and melanoma, is exposure to ultraviolet (UV) radiation [5]. While UV exposure can be from outdoor occupations, many individuals are exposed via intentional tanning. Such exposure can be from sun exposure and artificial UV radiation. Prevention strategies need to account for psychological reasons for tanning and use of artificial UV tanning devices. Such strategies also need to understand behavioral aspects of sunscreen use given that some studies have suggested sunscreen as a

Financial & competing interest disclosure

The authors have no relevant affiliations or financial involvements with any organization or entity with financial interest in or financial conflict with the subject matter or materials discussed in this manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

No writing assistance was utilized in the production of this manuscript.

risk factor for melanoma without properly adjusting sun sensitivity since it is known those at highest risk of melanoma are the highest users of sunscreen [6].

Varying sun exposure patterns have been associated with each form of skin cancer. Squamous cell carcinoma has been most consistently associated with chronic UV exposure [7, 8], whereas, melanoma and basal cell carcinoma have traditionally been associated with intermittent sun exposure [5, 8, 9]. Understanding environmental risk factors for melanoma, particularly UV radiation, have been complicated by the strong relationship with the skin's sensitivity to the sun [10] which has a major impact on behavior and possibly tanning attitudes. The potential carcinogenic effect of UV radiation may work through injury to the skin. Such dermatologic injuries include sunburn, benign papillomas, solar keratosis, and photocarcinogenesis leading to non-melanocytic skin cancer. The potential carcinogenic effect is further supported by studies from skin-biopsies taken after short-term tanning salon exposures, which have shown significant molecular alterations [11, 12]. Therefore, long term sunbathing or frequent artificial UV tanning device use, both of which involve exposure to UV radiation, may be carcinogenic. Disease prevention strategies need to be based on a full understanding that includes scientific issues related to etiology along with an appreciation for how social and other considerations impact tanning behaviors.

Intentional tanning

In searching for articles on tanning attitudes and behaviors, we found surveillance surveys on artificial UV tanning device use and sunbathing. Such studies provide insight on attitudes or beliefs regarding tanning behavior and reasons for artificial UV tanning use among users. In addition, several articles provide interesting information regarding parental behavior and attitudes towards tanning. Intentional tanning is defined in various ways from deliberate sun exposure to sunbathing, but also includes artificial UV tanning. While we did not conduct a comprehensive review of sunbathing, we pooled across the studies to determine tanning behavior and attitudes. We found an average sunbathing rate of 32–33% among adolescents and adults (Table 1) [13–22]. These behavioral studies suggested lower rates of artificial tanning than sunbathing [13–16, 18–40]. A higher percentage of adolescents reported that they were “currently tanning” than did adults (Table 1). These data suggest that tanning is important in over a third of the population with a higher importance among adolescents.

Many articles on adolescent tanning also report rates of artificial UV tanning device use among adolescents (Table 2). The rate of use under age 13 was fairly low in most populations; several studies reported little or no use at age 0–12 [31], age 11–13 [21], and among 6th graders [36]. This may reflect tanning salon regulations in several states within US that prohibit use under specific ages and/or require parental written permission. Hence, most states that have such regulations prohibit use by individuals under age 14. Table 2 reports artificial tanning device use by age [13–15, 21, 23, 27, 28, 30–32, 34, 36, 39, 41]. These studies suggest use increases through college age with a decline around age 22.

Overall, the literature suggests that a higher percentage of female adolescents use artificial tanning devices than do males (Table 2). While the prevalence of artificial tanning device use by Australians is generally low, a recent study found use was more common among women aged 25 to 44 years (14%) and girls aged 15 to 17 years (7%)[16]. Another study found that females had more positive attitudes towards artificial UV tanning and perceived greater use among their friends [42]. These researchers found that the increase in the importance of what people close to the students feel they should do (normative beliefs) was associated with identification with the popular peer crowd. For this group, tanning appears to be perceived as a way to achieve attractiveness. In contrast, the study showed protection against risky UV attitudes and behaviors was prominent in the “brain” crowd [42]

Three of the studies in Table 2 also reported current artificial UV tanning rates (in the past year) among parents with two reporting lower rates of artificial UV tanning in the past year [23, 31] and a third study reporting higher rates [27]. The one study reporting rates of ever use among parents showed a higher percentage of parents having ever used the devices than seen among their children [31]. Four other studies [29, 33, 37, 43] reported adult artificial UV tanning device use by age (Table 3). In the two reports of use in the past year and one of the two reports of ever use, artificial UV tanning use decreased with age. The reduced percentage of individuals using artificial tanning devices at older ages may reflect differences by birth cohorts or attitudinal changes at older ages.

These studies of sunbathing and artificial UV exposure suggest high UV radiation exposure among many adolescents and adults. One study found that 77% of artificial UV tanning device users also sunbathed compared to 51% of non-users [19]. The authors suggested that artificial UV tanning device users typically sunbathe in the summer and used artificial UV tanning devices in the winter thus receiving a high cumulative dose of UV radiation [19]. It appears that many individuals who use artificial UV tanning devices will receive a high cumulative dose of UV radiation, since in general they already sunbathe and only a limited number of individuals decrease their sunbathing when they use artificial UV tanning devices. This is supported by data from a Swedish study of adolescents that found outdoor tanning to be one of the strongest determinants of artificial UV tanning use [14].

While the percent of individuals using artificial UV tanning devices may be lower than the percent who sunbathe, the amount of UV radiation received may be higher among artificial tanning device users even if these were exclusive groups. Modern tanning beds use high levels of artificial UV radiation to tan the skin faster than the sun. This can represent either chronic UV exposure or intermittent UV exposure, depending on the pattern of use. Prior to the 1980's, sunlamps which could irradiate only a localized area with primarily UVB and some UVC were the more popular forms of artificial UV exposure [44]. Now tanning beds or standing booths can irradiate nearly 100% of exposed skin and emit more UVA and some UVB. With high levels of UV radiation and exposing nearly 100% of someone's skin, artificial UV tanning devices can have higher doses of UV radiation than equivalent time sunbathing. Modern cosmetic tanning bulbs can emit UVA at doses 2–3 times that of average sunlight in temperate climates with low doses of UVB, but similar to bright sunlight in tropical climates [45, 46]. However, sunbathing and artificial UV tanning device use are not typically exclusive. Artificial UV tanning device use correlates strongly with sunbathing habits in natural sunlight [44]. This suggests high UV radiation among artificial users is due to both artificial and natural UV exposure. Thus, understanding attitudes and behaviors regarding both artificial and natural UV tanning is important, particularly among young people.

To understand why rates of intentional tanning are high among adolescents and appear to continue through the late twenties before dropping, many studies surveyed both adolescents and adults regarding their general attitudes and beliefs related to intentional tanning. The reasons for using artificial UV tanning devices were often also described. Studies used a wide range of terms and questions to gauge attitudes among adolescents and adults. While the questions may not be directly compared across studies due to differences in wording, studies have clearly attempted to quantify the general aesthetic appeal of a tan [19, 21, 23, 25, 26, 38, 40, 47–50] as well as the attitudes related to tans being perceived as attractive [15, 26–28, 30, 35, 40, 50], sexy [28, 40], or providing a thin appearance [15, 40, 50]. Many studies also asked if individuals felt a tan looked healthy [15, 16, 19, 22, 23, 26, 28–30, 35, 40, 43, 47–51]. Additional reasons commonly sought for tanning included feeling good with a tan or while in the sun [15, 47, 48]. Socializing and friends' attitudes towards tans were commonly examined [21, 25, 27, 35, 40]. When we summarized such information across

studies, the attitudes that were the highest included socializing with friends and the perception that a tan looks attractive or sexy (Table 4). Over fifty percent of subjects identify with several reasons for tanning. A higher percentage of adults than adolescents appeared to believe that a tan is attractive. Socializing was a more common reason for tanning among adolescents.

In a study of Midwestern fraternity and sorority students, 84% stated that having a tan was very or somewhat important [15]. When asked what method of tanning they preferred, over 70% preferred sunbathing with about 10% preferring artificial UV tanning devices and only 5% preferring sunless tanning sprays. With 79% of these students reporting artificial tanning device use in the prior year, it leaves a question as to why the rate is so high if they prefer sunbathing.

Reasons for artificial tanning device use

Reasons for using artificial tanning devices seemed to be more consistently and clearly articulated in surveys than general reasons for tanning. These reasons included relaxation [15, 18, 20, 29, 30, 33, 37], vacation preparation [18, 29, 33, 37, 40, 52], protection before going in the sun [15, 20, 29], to avoid the sun [15, 29, 52], aesthetics [15, 18–20, 29, 30, 33, 37, 52], medical reasons [18, 20, 29, 52], feel healthy [20, 37], happiness [18, 30], self-confidence [18, 33], and influenced by friends [15, 20, 29, 40]. While the percentage of subjects reporting each rationale varied (Table 5), pooling these percentages provides some estimate of how common each reason for artificial tanning was. Similar to overall tanning attitudes, a higher percentage of individuals reported aesthetics (52%) as a reason for using artificial tanning devices. Over 50% of individuals stated that they used artificial tanning devices to relax. Attitudes that result in artificial tanning device use related to aesthetics and potentially relaxation may be difficult to change. Several other reasons given were to reduce or prepare for outdoor tanning (vacation preparation, to sunbath less, or to provide a protective base before going out in the sun). Such reasons may provide insight into the attitudes of some users that may assist with interventions to reduce UV exposure among adolescents and adults.

UV exposure

The amount of UV radiation an individual needs to obtain abnormal redness of the skin (the beginning of a sunburn) is called their minimal erythmal dose (MED). Less UV radiation is needed to produce abnormal skin redness among fair-skinned individuals than is required for dark-skinned individuals. However, time of day, season and latitude all influence the amount of UV radiation available for absorption [53]. This is outlined in Box 1. Skin sensitivity to the sun is measured in a variety of ways in surveys. Fitzpatrick skin-typing [54] by a dermatologist or trained physician is often considered the gold standard in measuring sun sensitivity. Fitzpatrick [54] proposed a skin typing scheme to attempt to categorize patients with white skin for the purpose of the treatment of psoriasis in the 1970s. Fitzpatrick based his system of classification on the theoretical concept of the skin's reaction to three MEDs. More specifically Fitzpatrick [54] stated that skin-type is based on how an individual burns and tans after sun exposure, with clearly defined types I and IV, and a less clear distinction between types II and III (Box 2). Later additional skin-types of V and VI for brown and black-skinned individuals were added [54]. When relying on self-report many studies have asked the two questions described in Box 2 separately as “tendency to sunburn” and “ability to tan”, while others have used self reported skin color or skin-type (Table 6).

Box 1**Factors influencing the minimal erythema dose (MED)**

- Intensity of radiation: time of day, time of year, distance from equator
- Sun sensitivity
- Length of time skin is exposed
- Protection from clothing
- Protection from sunscreen
- Cumulative exposure: number and kind of exposures overtime

*The MED is the amount of UV exposure needed to cause abnormal redness of the skin, often considered the beginning of a sunburn.

Box 2**Fitzpatrick skin-typing as defined in his 1988 publication**

Fitzpatrick describes his skin typing in terms of the response to the following two questions [54]:

“How painful is your sunburn after 24 hours?” and “How much tan will you develop in a week?”

The sub-types would answer as follows:

- Skin-type I - painful sunburn at 24 hours & no tan at sever days
- Skin-type II - painful burn at 24 hours and a light tan at seven days
- Skin-type III - slightly tender burn at 24 hours and a moderate tan at seven days
- Skin-type IV - no sunburn at 24 hours & a good tan at sever days

Two additional categories were later added:

- Skin-type V - naturally brown skin without sun exposure
- Skin-type VI- naturally black skin without sun exposure

Sun sensitivity measures attempt to correlate with MEDs. Studies examining the distribution of MEDs by skin-type found the range of MEDs to overlap among the categories [55–58]. Some studies show that skin color is better correlated with MEDs than Fitzpatrick’s skin-type [55, 58]. Regardless, interventions to reduce tanning by changing attitudes and beliefs may gain better compliance if tailored to sun sensitive skin-types. Fair-skinned adolescents, who strongly desire a tan that may take a lot of effort to obtain, may respond differently to strategies then would an adolescent who tans easily.

The American Cancer Society has several guidelines to prevent skin cancers. These guidelines focus on educating the public on ways to protect their skin from UV exposure when outside. The guidelines related to limiting sun exposure are highlighted in Box 3. Various educational campaigns have used these UV reduction guidelines. However, several behavioral theories would suggest that many of these strategies may not work among adolescents with a strong desire to tan.

Box 3**Strategies to prevent sun exposure**

- Limit direct UV exposure during mid-day
- Cover skin with long sleeved clothing when in sun
- Wear a hat with 2 to 3 inch brim
- Use a sunscreen with a SPF of 15 or higher
- Use sunless tanning lotions instead (Dihydroxyacetone)
- Wear sunglasses that provide adequate UV protection
- Seek shade when in sun
- Protect children from sun
- Avoid other sources of UV light from tanning beds and sunlamps
- Follow local UV index guides when going outdoors

Based on: American Cancer Society <http://www.cancer.org>

Behavior theory and tanning

Youth engage in tanning to enhance their appearance, and sometimes to relax, enhance mood, or to socialize. It is noted that about 30% of youth exhibit a level of dependence on tanning similar to other substance abuse addictions [59]. The most significant predictors for tanning dependence were found to be Caucasian race, moderate skin-type, indoor and outdoor tanning and sunbathing, and lower skin protection behaviors, as well as current smoking status and a healthy body mass index. This suggests strategies are needed that aim at teenagers with skin-types II and III.

Knowledge of the harmful effect of UV radiation appears to be unrelated to reduced tanning behavior [18]. One study reported that such knowledge did not influence behavior, with 90% aware that sunlight causes skin damage [19]. Another adolescent study showed that more knowledge was associated with more sunbathing [60]. Our previous study findings among Midwestern sorority and fraternity students were similar in that those with higher knowledge were more likely to use artificial tanning devices. Branstorm et al. [60] found that knowledge of UV radiation and skin cancer was good among adolescents, but did not affect sunbathing habits or the intention to change them. Tanning device use in a study of children was not related to knowledge of their parents, but kid's use was related to parental tanning device use (1). Behavioral research indicates that knowledge and awareness work best at changing individuals who have no intention of changing in the next six months (pre-contemplators) to intending to change or starting to change overt behaviors, however, these strategies will not work among adolescents who suffer from the illusion of immortality [61].

Importance of tanning as related to appearance

Several models of protective health behaviors argue that appearance may be important in motivating health-promoting behaviors. Our pooled data (Table 4) and others suggest that the degree to which people engage in excessive tanning is strongly correlated to their concerns with being physically attractive rather than to their knowledge about risks associated with UV exposure [62]. Hillhouse et al. [63] examined tanning behaviors among university students (using the theory of planned behavior). The best predictor of tanning

salon use in their sample was the intention to go to a tanning salon, which was further influenced by a favorable attitude to tan, perceptions of what others believe (subject norms), and perceived control of behaviors. Among the attitudes to tan, an intention to appear attractive predicted tanning salon use more than an intention to appear healthy. Another study of college students examined attitudes toward sunbathing (using the theory of alternate behavior) and found that when students' orientations toward appearance, outdoors, social norms and perceived consensus increased, the attitudes towards sunbathing became more positive [64]. The same was not replicated for an orientation towards health. A study on exploring the development of sun-tanning behaviors among adolescents in Canada found that external influences like peers and media were the greatest predictors for adolescents tanning exposures [65]. Another study of the role of appearance-based factors in predicting sunbathing and indoor tanning among female college students found "that intentions mediate the relationship between appearance attitudes and tanning behaviors, appearance reasons to tan and intentions mediate the relationship between socio-cultural influences and tanning behaviors, and appearance reasons not to tan and intentions mediate the role of perceived threat on behaviors" [66].

The social side of tanning

Stapleton et al. [42] found a significant association between artificial UV tanning behavior and popular peer crowd identification independent of participant's gender and skin-type in a sample of college students. They suggested that social pressure played an important role among peer crowds to tan and appear attractive and maintain a group image, and any deviation from this behavior negatively affected an individual's sense of identity. Socializing was reported as important among adolescents in several studies (Table 4). Related, a study of predictors for self-tanning product use among college students found that the participants' significant others' or romantic partners' support for a tanned look positively reinforced self-tanning behaviors among respondents [67]. While this has negative connotations regarding tanning, this relationship with use of sunless tanning products can be used for designing interventions.

The vitamin D controversy

Some research suggests mild or moderate exposure to UV radiation to produce vitamin D may have beneficial effects in preventing colorectal cancer [68] or death from it [69]. A recent study showed a reduction in endometrial cancer with artificial UV tanning device use and sunbathing probably due to increased levels of vitamin D [70]. Such reports have resulted in mixed messages in Australia regarding health and sun exposure that have led to decreased sun protection practices in residents of Queensland which has high amounts of UV radiation that account for some of the highest rates of melanoma in the world [71]. Of particular concern was the belief among one-third of participants that a fair-skinned person needs at least 30 minutes of mid-day sun exposure to maintain healthy vitamin D levels [71]. Holick [72] states that full-extremity exposure to sunlight equivalent to about 25% of one minimum erythema dose (MED), two to three times a week is more than adequate to satisfy the body's vitamin D requirement. Such data suggest that at a UV index of 6.7 or higher it would take about 5 minutes to obtain adequate amounts of vitamin D from UV radiation. In Sydney Australia, the UV Index is over 8.0 for 6 months of the year and at its lowest in June (winter) it is 2.4 [101] which would require less than 15 minutes of mid-day full sun exposure, two to three times a week [72]. Clearly a better public health understanding is needed regarding UV radiation and its potential affects on vitamin D levels and how both are related to cancer rates.

Intervention strategies that can be implemented to reduce tanning

The research team that found attitudes and social norms to predict tanning salon use subsequently conducted a follow-up intervention study where an appearance-based intervention was implemented as a randomized trial among college aged students [73]. This study found clinically significant beneficial effects in reducing artificial UV tanning use tendencies among the intervention group compared to the control group. This research suggests that changing norms may be possible. Strategies that address changing peer and social norms of the attractiveness of a tan will need to include local adolescent leaders, but could also use societal role models such as athletes and actresses. Changing of how the media portrays tanning is not going to happen with one intervention and may take decades to change, especially since it is circularly related to societal beliefs.

Current perceived benefits of tanning and related future long-term risks were examined in another study. Their model showed that people perceive tanning as a current utility and tend to disqualify its long-term utility. Based on this model, the authors recommend prevention programs that lower the immediate perception of the utility of a tan among children and teens, and change societal norms for sun exposure behaviors and a preference for tanned appearance [74]. While changing perceptions at a young age makes sense, changing societal norms is not a simple task to achieve these goals. Another study examined behavior alternatives for enhancing appearance, relaxation, and socialization among college students. They found that favorable attitudes towards having a hobby to relax and going to gym to socialize were negatively associated with tanning salon use [75]. This provides another outlet for relaxation and socializing that could be used in future interventions.

A behavioral intervention study conducted by Mahler et al. [76] examined UV photographs and information on photo-aging such as wrinkles and age spots to promote sun protection intentions and behaviors among young adults. Three groups were randomized in the study to receive one of the three interventions namely; UV photograph and photo aging intervention, UV photograph and photo aging intervention plus a sunless tanning intervention, and no intervention (control group). As a result, a significant benefit was noted when the participants who received some form of intervention reported a stronger sun protection intention relative to those who did not receive any intervention. Furthermore, the group that received an additional sunless tanning intervention reported a greater sun protection than the group that received just the UV photograph and photo aging intervention. Thus the study recommended that UV photographic intervention can promote sunless tanning among young adults. While these results are very encouraging in young adults, it is unclear if focusing on premature aging and wrinkling of the skin alone will affect adolescents if they feel they are indestructible. However, combining that intervention with the sunless tanning intervention may present adolescents with an alternative method of obtaining their tan.

Sunless tanning products include spray-on tans, sunless tanning creams, and lotions as an alternate to sunbathing or artificial UV tanning. These products are shown to provide the desired tanned look without increasing one's risk of UV radiation-induced skin cancer. The chemical component of sunless tanning products, called dihydroxyacetone (DHA), darkens the skin by reacting with the amino acids in the outermost layer of the skin. DHA has been approved and regulated by Food and Drug Administration [77] and approximately 10% of US adults reported to have used sunless tanning products [78]. It has also been noted that sunless tanning products provide a slight protection from UV-A [79] and UV-B [80] radiation, but the recommendation is to use them in combination with long sleeved clothes and sunscreens [81]. One study showed that sunless tanning product users were in fact more likely to use sunscreens and adhere to other sun protection habits [78]. However, there has also been a mention that sunless tanning product users experience a false sense of sun

protection using these products, and are prone to unprotected sun exposure. Another study reported a higher rate of sunburns among sunless tanning product users in the past year [82]. A recent pilot study examining non-solar tanning behaviors among adolescents and adults found that 20% of participants falsely assumed powder or makeup bronzers to be sunless tanning products [83]. Thus, while there may be a potential benefit in promoting sunless tanning as an alternative to UV induced tanning, more needs to be examined about the physiologic effects of sunless tanning products, as well as the attitude and behavioral correlates of people who use these products.

Conclusion

Age does matter regarding adolescent tanning practices; There is little or no use of artificial UV tanning devices for ages 13 and younger, with rates increasing from age 14 through college age then declining around age 22. Studies of adults suggested a decline beginning between ages 23 and 30. Future interventions to reduce tanning among adolescents should be aimed at finding new strategies to initiate behaviors that reduce exposure risk, such as changing beliefs about the importance of a tanned appearance or use of sunless tanning products instead of UV radiation to achieve a tan. Several potential strategies based on the prior discussion are outlined in Box 4. Behavioral theories that focus on maintenance will not be effective given the lack of importance adolescents give to tanning risks. Strategies to change behavior in adolescent populations must focus on initiation not maintenance of behavior changes. Changes will occur when adolescents identify their values as they relate to tanning behavior. Tying values to more healthy tanning practices has the potential to modify behavior. Interventions in adolescents may need to focus on factors other than changing beliefs regarding appearance, such as providing behavior alternatives.

Box 4

Potential strategies for interventions to reduce harmful tanning behaviors among adolescents

Interventions could:

- Use the knowledge that adolescent artificial UV tanning device use is related to parental use by designing an intervention aimed at parents of pre-adolescent children
 - Barrier: Potential for lack of parental buy in since it the intervention would include getting parents to reduce their exposure as a role model for their children
 - Enabler: Potentially high motivation among parents who participate to reduce their children's exposure, along with creating awareness of their children's tanning practices
- Suggesting the alternative behavior of using sunless tanning sprays
 - Barrier: Cost of sunless tanning sprays, particularly after the intervention. However, the cost may reduce as more products are developed and sold.
 - Enabler: Sunless tanning sprays are a safe alternative to UV exposure, but can be combined with minimal UV exposure needed for adequate to satisfy the body's vitamin D requirement.

- Addressing specific reasons for tanning such as the perception that artificial UV tanning provides a base tan that may help protect the skin from harmful affect of the sun
 - Barrier: Subjects may tan for multiple reasons making motivation for change more complex and difficult
 - Enabler: Subjects may be motivated to reduce the harmful effect of UV radiation on their skin

More challenging interventions might:

- Use the knowledge that a high percentage of tanners do so based on the importance of appearance
 - Barrier: Changing attitudes and beliefs, particularly in adolescents
 - Enabler: Local adolescent leaders and other role models such as athletes and actresses
- Use the knowledge that peers and media strongly influence tanning behaviors
 - Barrier: Changing attitudes and beliefs among peers and the potential cost of media interventions
 - Enabler: Providing alternative hobbies to relax and/or ways to socialize, such as going to the gym

Future perspective

Over the next 5–10 years, skin cancer research will further expand into behavioral research to incorporate social and behavioral aspects of health behavior related to skin cancer. Unfortunately, global changes in adolescent attitudes and beliefs are unlikely to change quickly. This is in part because the increase in tanning during adolescence through the twenties is likely related to both the adolescent illusion of immortality and lifestyle changes related to completing school, obtaining a full time job, and other responsibilities such as having children. The trends in tanning summarized here suggest that the melanoma rates will continue to increase in younger age groups. However, regulation of salons providing artificial UV tanning will likely change to include more global restrictions of use by younger adolescents. This will eventually aid in reducing skin cancer rates. Additionally, as skin cancer research incorporates more behavioral and attitudinal research, our understanding of potential alternatives to sun exposure and tanning salons (such as sunless tanning sprays) will expand thus allowing for more creative intervention strategies for skin cancer prevention.

Acknowledgments

This research was supported, in part, by the National Cancer Institute, grant numbers K07CA104556 and R03CA099520.

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Executive summary

- Over 30% of adolescents (and adults) sunbath.
- While many adolescents say they prefer to sunbath, on average about 14% currently use artificial tanning devices.
- The top reasons for tanning include aesthetics and socializing, with a higher percentage of adolescents reporting these reasons.
- Artificial tanning device use appears to begin in teenagers and increase through the early twenties, declining after ages 30–45.
- Among adolescents, those with moderate skin color (skin-types II & III) appear to be at the highest risk of skin damage based on their behavior, making them a good target for interventions.
- Knowledge of the harmful effect of UV radiation has little association with tanning behavior.
- Interventions should aim at multiple attitudes and behaviors, since a combination of influences determine tanning behavior.
- Providing behavioral alternatives such as sunless tanning has potential for success in adolescents and young adults.

Table 1

Percentage reporting intentional tanning and artificial UV device use to tan: adolescents vs. adults

Percentage reported among studies:	Overall % (N)	(Minimum, Maximum)	Among adolescents % (N)	Among adults % (N)
Sunbath / intentionally tan	32.3 (13)	(14.8, 100.0)	33.0 (6)	32.0 (7)
Artificial UV tanning device *				
... ever use	21.4 (23)	(3.0, 84.6)	20.1 (13)	22.0 (10)
... current use	13.9 (16)	(1.0, 56.0)	14.6 (8)	9.3 (8)
... paired studies for adolescents & parents	15.0 (8)	(3.0, 59.0)	10.3 (4) adolescents	17.9 (4) parents

N = number of studies

* Artificial UV tanning devices include tanning beds, sunlamps, and commercial UV tanning booths.

Table 2

Age-distribution of artificial tanning device use among adolescents and their parents reported among studies.

Author(s)/Publication year/Survey Year	age range	# of subjects	Past year %	ever %	# of females	Past year %	ever %	# or males	Past year %	ever %
Banks 1992 1989	16–19	96	23.1		40	33		56	16	
	18–19				9	56				
Mermelstein 1992(before 1992)	9 th grade	758		9.3						
	10 th grade	839		16.8						
Olyphant 1994(before 1994)	14	135		18						
	15	303		29						
	16	261		34						
	17	283		46						
Reynolds 1996 (before 1996)	6 th grade	465		3.3						
Boldeman* 2003 1993	15	242	40.9		114	52.6		128	30.5	
	16	259	54.1		134	70.1		125	36.8	
	17	218	56.4		117	69.2		101	41.6	
	18	258	64.3		134	80.6		124	46.8	
Robinson 1997 1994	19	213	65.3		73	79.5		140	57.9	
	11–13	217	0.0							
	14–16	210	8.6							
	17–19	231	16.5							
Boldeman* 2003 1999	15	576	17.2		290	26.9		286	7.3	
	16	562	26.3		308	37.3		254	13.0	
	17	538	31.0		290	43.4		248	16.5	
	18	587	40.7		324	52.8		263	25.9	
Cokkinides 2002 1998	19	628	47.5		330	60.9		298	32.6	
	11–12					5.6			2.1	
	13–14					5.0			2.7	
	15–16					19.4			5.8	
Caregivers 27+	17–18	1187	8.1			39.6			10.9	

Author(s)/Publication year/Survey Year	age range	# of subjects	Past year %	ever %	# of females	Past year %	ever %	# or males	Past year %	ever %
Lazovich 2004 2000	14	252	10.3							
	15	345	22							
Stryker 2004 2000-01	16	333	35.7							
	17	342	48.3							
	14	261	7.7							
	15	346	17.6							
Kancherla Unpub 2003	16	333	31.5							
	17	343	41.4							
	18	138		65.9	86		80.2	52		42.3
Demko 2003(before 2003)	19	49		49.0	22		68.2	27		33.3
	20	28		42.9	14		71.4	14		14.3
	21	22		45.5	9		100.0	13		7.7
	22-25	18		27.8	4		50.0	14		21.4
	13-14	1334		7.2	741		11.2	593		2.1
	15	1178		15.4	636		24.3	542		5.0
	16	1491		17.8	768		29.2	723		5.7
	17	1443		23.1	729		36.5	714		9.5
	18-19	1457		28.8	676		47.0	781		13.1
	18	16		68.8	13		84.6	3		0.0
Dennis 2009 2004	19	59		84.8	45		91.1	14		28.6
	20	55		94.6	41		97.5	14		78.6
	21	18		77.8	12		100.0	6		33.3
	22-23	11		45.5	3		33.3	8		25.0
Hoerster 2007 2005	14	1252								
	15	1456		8.8						
	16	1406		13						
Magee* 2007(before 2007)	17	1160		17.5						
	parent	5274		23.9						
	0-12	534		0.4			0.6			
	13-16	72		3.0			10.0			
	>17	81		20.0			25.0			

Author(s)/Publication year/Survey Year	age range	# of subjects	Past year %	ever %	# of females	Past year %	ever %	# or males	Past year %	ever %
parents 16-65		364	6.0	59.0						

* current tanning bed use not otherwise defined.

Table 3

Age-distribution of artificial tanning device use among adults

Author(s)/Publication year/Survey Year	age range	# of subjects	Past year %	Ever %
Rhainds [37]	16–24	138	19.5	
1999	25–34	246	17.1	
1996	35–44	286	8.3	
	45–54	230	6.1	
	55–60	102	3.9	
Knight [29]	17–22	402	52.0	63.9
2002	23–27	60	20.0	45.0
1999	>27	25	12.0	40.0
Dissel [33]	<29	164		50
2009	29–64	982		27.9
2002	65+	96		11.5
Borner [43]	14–17	81		18.5
2009	18–29	220		39.1
2007	30–44	426		43.2
	45–59	341		22.0
	60+	432		14.8

Table 4

Comparison of tanning attitudes between adolescents and adults.

A tan ...	Percentage reported among studies:		
	Overall % (N)	Among adolescents % (N)	Among adults % (N)
... makes me more comfortable socializing with friends	75.6 (5)	75.9 (4)	64.0 (1)
... looks better (other aesthetic reasons)	69.7 (16)	72.5 (9)	51.3 (7)
... is attractive	60.9 (8)	57.4 (5)	66.4 (3)
... is sexy	54.8 (2)	53.3 (1)	56.0 (1)
... looks healthy	37.4 (16)	35.4 (8)	38.8 (8)
... makes me look thinner	27.7 (3)	23.3 (1)	28.9 (2)
The sun feels good	69.1 (6)	69.1 (6)	- -

N = number of studies

Table 5

Summary of reasons for using tanning beds or sunlamps among the studies reviewed

	Overall % (N)	Range (Minimum, Maximum)
... aesthetics *	52.5% (9)	(30.0%, 92.0%)
... relaxation	50.5% (7)	(11.8%, 74.6%)
... vacation preparation	41.7% (6)	(19.0%, 61.0%)
... happiness or lifted spirits	40.1% (2)	(14.0%, 51.0%)
... to gain a protective base	32.6% (3)	(15.0%, 54.7%)
... influenced by friends	26.1% (4)	(7.3%, 60.0%)
... feel healthy	17.3% (2)	(10.8%, 29.0%)
... self-confidence	14.3% (2)	(11.7%, 20.0%)
... treatment of medical or skin condition	4.9% (5)	(1.0%, 15.0%)
... to avoid the sun	1.7% (2)	(1.0%, 6.8%)

N = number of studies

* Aesthetics includes to look or feel better and an improved appearance.

Table 6

Descriptions of self reported measures of sun sensitivity.

Sun Sensitivity measures	Examples of typical questions:
Tendency to sunburn	When your skin is exposed to strong sunlight for 30 minutes for the first time each spring or summer with no protection, does it get... a severe and painful sunburn, moderate sunburn, mild sunburn, or no sunburn?
Inability to tan	After repeated and prolonged exposure to the sun, does your skin become... deeply tanned, moderately tanned, mildly tanned, or have no tan?
Skin color	How would you describe your untanned skin color on your upper inner arm? (fair, medium or dark)
Self-reported skin-type	Your skin's reaction after a few days of exposure to the sun does is...tan, no burn; burn, moderate tan; burn, light tan; or burn, no tan?