

# The impact of an appearance-based educational intervention on adolescent intention to use sunscreen

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## Abstract

**During adolescence, there is a steady decline in the use of sun protection and increased use of indoor tanning lights. Previous health education efforts have changed knowledge but not these behaviors. Middle school students ( $n = 113$ ) received a single educational class that included personal viewing of skin changes visible under ultraviolet (UV) filtered light. Pre-/post-surveys assessed past, current and future intent to use sunscreen, as well as sun benefit and sun risk attitudes. Prior to the session, 42% were sunscreen non-users and 21% were consistent users. At post-test, one-third of students who had not previously intended to use sunscreen in the next month now intended to use it. Among students who had seen skin damage, 59% reported intention to use sunscreen in the next month versus 35% who did not see skin changes ( $P = 0.04$ ). Viewing sun damage was an independent predictor of intent to use sunscreen in the next month (OR 2.9,  $P = 0.04$ ), as was older age (OR 2.6,  $P = 0.04$ ) and previous consistent sunscreen use (OR 6.1,  $P = 0.004$ ). A brief educational intervention that emphasizes risk-to-appearance and personalizes the risks of UV exposure has the potential to influence early adolescent sun protection. Long-term studies of this approach are needed.**

## Introduction

The prevention of skin cancer is a pediatric public health issue. Skin cancer rates are increasing 3–5% per year [1]. The most lethal skin cancer, malignant melanoma, is increasing more rapidly than any other type of cancer [2]. Clinicians, schools and community programs are urged to deliver messages to families to use more sun protection. Because adolescence is an important time where ultraviolet (UV) radiation increases skin cancer risk [3], interventions are particularly important. While parents play an important role in their child's sun protection, increasing independence beginning in early adolescence requires interventions directed at the youth. Starting in middle school and continuing through high school, the use of sunscreen, the major method of protection used, and other means of protection rapidly declines [4, 5]. Adolescents, as compared with younger children, have sunscreen use rates of about half and sunburn rates that are double [6, 7]. Surveys in different countries show that sunburn rates vary in different age group from 67 to 85% [8, 9]. Adolescents perceive a tan to be attractive and healthy [10]. Appearance-related factors are important predictors of sunbathing and tanning light use [11–13]. For many adolescents, the increased risk of later adult health problems does not motivate them to change their current health risk behaviors that are pleasurable.

Educational efforts thus far with adolescents in schools have been successful at increasing knowledge and changing attitudes but have not changed early adolescent's sun behaviors or plans to use sun protection [10, 14, 15]. These efforts have usually focused on increasing knowledge about skin cancer

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and education about sun protection rather than appearance issues related to UV radiation exposure.

Studies with older adolescents have shown that college students were more likely to change their behaviors when the risk-to-appearance was emphasized rather than health [16, 17]. This research used a new educational approach where the individual views their skin changes from sun exposure [18] as visible under UV light. This approach has been used with college students and adults at school and beach settings. In different studies, the viewing of their photo showing sun damage along with educational information about aging from the sun have consistently resulted in changes in both planned and reported sun protection motivations and behaviors [19, 20]. These changes in intention to use sunscreen resulted in a subsequent decline in sunbathing as well as increasing motivation to consider reducing exposure to UV radiation in college students and young adults. In one study, this risk-to-appearance intervention resulted in improved sun protection up to 2 years later [21, 22]. Thus far this new approach has not been used with younger adolescents.

This study explores the impact of an adolescent health- and appearance-focused educational intervention, including viewing of facial skin changes under UV light, on future intentions to use sunscreen.

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## Methods

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### Intervention

All seventh- and eighth-grade students in a rural Vermont middle school participated in a sun protection health education session with two components. In health classes in late May, students first received a 30-min educational session with visual materials on the risks of sun exposure as well as practical strategies about how to improve sun protection. Adolescent specific images and messages stressed that teens can have fun outdoors and still protect themselves. Multiple methods of protection and sun avoidance were encouraged. Specific messages about photoaging and appearance-related

issues were included. Next, students viewed their face under filtered UV light using a Dermascan™. This portable device provides a darkened environment with a mirror to view skin changes not visible under normal light. Chronic sun exposure leads to non-uniform epidermal pigmentation that appears as spots or haphazard pigmentation. The specific skin changes related to UV light exposure were explained to the entire class during the educational session and to individuals during the viewing of their face. While staff emphasized that these early skin changes were not skin cancer, they did explained the importance of sun protection to reduce future damage. A second viewing window allowed the adolescent to invite a peer to also see their face. Peer viewing was encouraged because it promoted peer discussion and helped establish a pro-sun protection social norm among the classmates. Opportunities were provided for students to ask questions after both the educational and viewing components.

### Measures

#### *Sunscreen use*

Based on the theory of reasoned action [23], behavioral intention for using sunscreen was assessed. In addition, based on the transtheoretical model [24], current, past and future use of sunscreen and pros/cons of sun protection were assessed. Sunscreen use was selected because in our pilot work which assessed adolescent sun-related behavior, there was better test-retest reliability for sunscreen use questions than questions about other sun protection methods. While multiple sun protection measures are appropriate, targeting sunscreen use as a specific behavior to promote is appropriate because of the steady decline in sunscreen use beginning in early adolescence [4, 5] resulting in sunscreen use rates that are half that of childhood. Respondents were asked three questions about sunscreen use with yes/no responses: (i) Do you use sunscreen with at least sun protection factor (SPF) 15 when out in the sun for more than 15 minutes? (ii) Have you been using sunscreen with at least SPF 15 for the last 12 months? and (iii) Do you intend to use sunscreen with at least SPF 15 for the next 30 days?

The *a priori* outcome measure was intent to use sunscreen in the next 30 days as measured at the post-intervention survey.

### *Sun benefit and sun risk attitudes*

Based on existing literature [10, 13] and our work with a cohort of middle school students, two sets of questions were developed to assess pro-sun exposure attitudes and pro-sun protection attitudes. Factor analysis of questions and inclusion of items with Cronbach's alpha  $>0.65$  resulted in three items for a sun benefit attitude scale and three items for a sun risk scale. Sun benefit attitude statements were (i) being in the sun is relaxing, (ii) a tan looks good and (iii) tan people look healthy. Sun risk attitude statements were (i) sun and UV light damage cause wrinkles, (ii) bad sunburns are unhealthy and (iii) too much sun exposure causes skin cancer. Respondents answered the three items in each attitude scale on a scale from 1 to 4 ranging from definitely agree (1) to definitely disagree (4) for the above statements. Total scores ranged from 4 to 12.

### *Evaluation*

The day before the education session, all students ( $n = 113$ ) completed a questionnaire assessing current and past sunscreen use and sun benefit and sun risk attitudes. Two weeks later, the students completed the same survey in their health education classes. In the second survey, they were also asked if they planned to use sun protection more, if they had viewed themselves in the Dermascan™ and whether they saw skin damage (none, some or a lot). The follow-up surveys were completed by 109 students and included one student who had been absent on the day of the first survey. Repeat surveys were not obtained for the five absentees leaving 108 paired pre-post surveys. Surveys were anonymous and matched by identifier codes. Gender data were not available. Our institutional human subjects review board approved the study protocol and measures.

### *Data analysis*

To determine the impact of Dermascan™ viewing, scores were collapsed into a dichotomous response;

some or lots of damage seen as 'skin damage seen' and no damage or did not look as 'damage not seen'. Students were classified as being consistent sunscreen users prior to the intervention if they had positive responses to both sunscreen use in the past 12 months and using sunscreen now. Two positive responses correspond to the maintenance stage of behavior in the transtheoretical model describing stages of change for sun protection [25, 26].

Changes in sun benefit and sun risk attitude scales were determined by subtracting pre- from post-total scores. Pre-post change in the attitude variables was assessed with paired student's *t*-test. A negative change in the sun benefit scale indicated fewer benefits perceived after the intervention. A positive change in the sun risk scale indicated more risk perceived after the intervention. Categorical variables were analyzed with chi-square statistics. A binary logistic regression model, with entry of all variables in one step, was developed to predict post-intervention intent to use sunscreen. The dependent variables were the pre-intervention sunscreen consistent user status (yes/no), skin damage seen and change in sun benefit and sun risk attitudes from the first to second survey. Complete data for this analysis were available on 103 students. Data analysis was performed on SPSS 11.0 statistical package.

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## Results

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The final study population consisted of 49 seventh-grade (43%) and 64 eighth-grade students (57%). All students were Caucasian. Prior to the intervention, 19.5% had used sunscreen in the past 12 months but did not currently use it, 41.6% had not used sunscreen in the past 12 months or now and 21% were consistent users of sunscreen (12 months before and now). Consistent use was more likely in older students (10.2% seventh grade versus 29.7% eighth grade, chi-square,  $P = 0.01$ ), but use of sunscreen in the past 12 months did not vary by grade. Among students who were not already consistent users, 29.5% of seventh graders and 30.3% of eighth graders intended to use sunscreen in the next month.

Most students at baseline were aware of skin cancer risk but few perceived appearance changes as an issue with sun and UV exposure (see Table I). The majority of adolescents endorsed benefits of sun exposure. After the intervention, student sun benefit and sun risk attitudes changed significantly. Less benefit was perceived on the sun benefit scale (paired *t*-test mean difference  $-1.23 \pm 2.1$  SD,  $P = 0.001$ ) and more risks on sun risk scale (paired *t*-test mean difference  $+0.37 \pm 1.5$  SD,  $P = 0.011$ ).

In the post-intervention survey 2 weeks after the educational session, students reported their experience with the Dermascan™. Fifteen percent of students had chosen not to view their face, 17% reported no damage, 48% reported they had seen 'some damage' and 20% reported 'lots of damage'. One-third of students who had not previously intended to use sunscreen in the next month now indicated that they intended to use it. Students who had seen skin damage were more likely to report intended use of sunscreen (see Table II). For the subgroup who had not used sunscreen consistently prior to the Dermascan™ viewing, 52% (28/54) of those with skin damage reported intended use of sunscreen in the next month. In comparison, only 24% (6/25) of the non-sunscreen using students intended to use sunscreen if they did not see skin damage (chi-square,  $P = 0.03$ ).

Intent to use sunscreen in the next month was not different by grade at baseline, but after the intervention, eighth graders were more likely than seventh graders to intend to use sunscreen (see Table II).

Not surprisingly, students who already consistently used sunscreen were more likely to intend to use sunscreen after the intervention than previous non-users (see Table II).

The role of Dermascan™ viewing, grade, changes in either sun benefit or sun risk attitudes and pre-intervention regular sunscreen use on post-intervention intent to use sunscreen was determined by calculation of odds ratios. Table III shows that older students and students who already used sunscreen consistently were more likely to intend to use sunscreen. In addition to these predictors, students who viewed skin damage in the Dermascan™ were 2.9 times more likely to intend to use sunscreen in the next 30 days. Attitudes about sun benefits and risks had changed significantly after the intervention, increasing both the perceived pros (benefits) and cons (risks). However, this shift did not predict intent to use sunscreen. Logistic regression analysis examining post-intervention attitudes instead of change in attitudes also did not show any significant impact of attitudes on intent to use sunscreen (data not included).

## Discussion

A brief school intervention that incorporated a personalized appearance-based UV damage component increased student intent to use sunscreen in the next 30 days. While it was expected that students who already were consistently using sunscreen would continue to intend to use it in the future, both

**Table I.** Baseline adolescent attitudes about sun benefits and risks<sup>a</sup>

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
<b>Sun benefit attitudes</b>				
Being in the sun is relaxing	59 (52%)	42 (37%)	7 (6%)	5 (4%)
A tan looks good	72 (63%)	33 (29%)	8 (7%)	0 (0%)
Tanned people look healthy	21 (18%)	51 (45%)	32 (28%)	6 (5%)
<b>Sun risk attitudes</b>				
Sun and UV light damage cause wrinkles	23 (20%)	44 (39%)	24 (21%)	22 (19%)
Bad sunburns are unhealthy	69 (61%)	22 (19%)	10 (9%)	11 (10%)
Too much sun exposure causes skin cancer	66 (58%)	31 (27%)	9 (8%)	6 (5%)

<sup>a</sup>*n* = 113, totals do not equal 100% due to missing data for one to four respondents/question.

**Table II.** *Intent to use sunscreen post-intervention*

	Post-intervention: intent to use sunscreen in the next 30 days	P-value
Grade		0.01
Seventh	16/45 (29.6%)	
Eighth	38/61 (62.3%)	
Already use sunscreen consistently		0.001
Yes	19/23 (82.6%)	
No	36/83 (43.4%)	
Sun damage seen with Dermascan™		0.04
Yes	41/70 (58.6%)	
No	12/34 (35.3%)	

**Table III.** *Predictors of adolescent intent to use sunscreen in the next 30 days*

	OR	95% CI	P-value
School grade: seventh (ref.) versus eighth	2.61	1.04–6.59	0.04
Already use sunscreen consistently	6.13	1.76–21.3	0.004
Change in sun benefits score (post–pre)	1.22	0.89–1.68	0.21
Change in sun risks score (post–pre)	0.93	0.75–1.15	0.50
Skin damage seen: yes versus no/none (ref.)	2.85	1.07–7.6	0.04

students who were older and those who saw skin changes in the Dermascan™ were about two and a half times more likely to intend to use sunscreen in the next month. While the intervention resulted in attitude changes in the expected direction, neither attitude scores nor changes in attitude after the intervention predicted intention to use sunscreen in the next month.

The outcome measure of intent to use sunscreen has been strongly linked with actual sun behaviors in other studies. Intention to use sunscreen in fifth-grade students has been shown to be the strongest predictor of reported sunscreen use [27]. Change in intention to use sunscreen after a similar photoaging intervention in young adults resulted in both dramatic decreases in sunbathing and increased use of sunscreen in non-beach settings [19]. Future intent

is also a strong predictor of adolescent behavior with other health risk behaviors such as smoking and drinking [28].

Changing sun protection health behaviors has been challenging, especially for adolescents. Previous school-based 45-min educational interventions with high school students have changed attitudes and knowledge as this intervention did, but changed neither intentions nor self-reported sun protection [10]. A large scale delivery of a curriculum averaging 1–2 h delivered through the Environmental Protection Agency SunWise Program for adolescents changed knowledge and attitudes, and changed intent to use shade by 8%, but had a non-significant 2% change in intent to use sunscreen [14]. A survey of adolescents in Lebanon found that most were aware of an increased risk for skin cancer (90.7%) but fewer understood premature skin aging resulted from sun exposure. Again, knowledge did not translate into sun protection behaviors [8].

There are several reasons why this intervention may be more effective than earlier reported educational interventions that do not address appearance. Adolescent invulnerability may lead to attitudes that skin cancer is a remote adult problem. Perceived susceptibility to skin cancer has been linked to sunscreen use in teens [10]. Viewing current skin damage may increase feelings of susceptibility. Appearance enhancement has also been a prime motivator for seeking a tan [29]. The viewing of skin damage and potential premature aging of skin seen during the intervention would set up dissonance with adolescents seeking a tan to be more attractive. The greater effect in our older students is consistent with tanning behaviors and perception of the attractiveness of a tan increasing in older adolescence [13, 30]. The intervention's class-wide approach with discussion and sharing of Dermascan™ views was intentional to foster peer interaction that would promote the social norm that sun exposure leads to skin damage. Pro-sun protection social norms have previously been linked to increased likelihood of using sun protection in early and later adolescence [10, 27, 31].

There are several limitations in this study. In order to be the most reliable, we asked about a

specific outcome behavior involving use of sunscreen with SPF 15 when outside in the sun for >15 min for the next 30 days. Although we emphasized multiple means of protection and avoidance of tanning during the education session, we did not assess these items. Similar to other studies, adolescents in our follow-up survey did respond they were going to generally protect themselves more in the future significantly more often when they saw skin damage [19]. While we expect that adolescents were likely to change several aspects of sun protection, future studies are needed to address sun avoidance and use of clothing and hats as well as the longer term impact of the intervention. Another limitation is that we did not have data to explore gender or skin type effects. From our data on New Hampshire and Vermont children and adolescents, we know that about half have skin types I and II that burn always or usually burn [32]. We suspect that the students with more demonstrable skin changes had one of these skin types. Skin type influenced intention in Mahler's photoaging intervention, but further study is needed to know the relationship between skin type and visible damage in young adolescents.

In conclusion, a brief educational intervention that included viewing facial skin damage related to UV radiation exposure and peer response to skin damage can result in intent to change use of sunscreen and perhaps other sun protective behaviors. Many local American Cancer Society offices already have UV light filtered viewing units like our Dermascan™ available for loan for community events. We encourage adolescent sun protection educational sessions that utilize peer and observed personalized risk assessment (an electronic version of the PowerPoint slide presentation and viewing guidelines for Dermascan use with adolescents is available on request from the corresponding author). This approach can be adapted for a variety of settings from physical education classes to health classes or health fairs. While further studies of its longer term impact on a variety of sun behaviors are needed, the improvement over current education only approaches that have had little impact on teens indicates it is time for an adolescent educational

approach that acknowledges the importance of appearance.

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### Conflict of interest statement

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None declared.

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