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Beyond the usual suspects: target group- and behavior-specific factors add to a theory-based sun protection intervention for teenagers

Natalie Schüz · Michael Eid

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Abstract Sun protection standards among teenagers are low while sun exposure peaks in this age group. Study 1 explores predictors of adolescent protection intentions and exposure behavior. Study 2 tests the effectiveness of an intervention based on these predictors. Study 1(cross-sectional, N = 207, ages 15–18) and Study 2 (RCT, N = 253, ages 13–19) were conducted in schools. Path models were used to analyze data. Self-efficacy ($\beta = .26$, $p < .001$) and time perspective ($\beta = .17$, $p = .014$) were the strongest predictors of intentions; appearance motivation ($\beta = .54$, $p < .001$) and intention ($\beta = -.18$, $p = .015$) predicted behavior. The intervention effected changes in all predictors except self-efficacy. Changes in outcome expectancies ($\beta = .19$, $p < .001$) and time perspective ($\beta = .09$, $p = .039$) predicted changes in intention, while changes in intention ($\beta = -.17$, $p = .002$) and appearance motivation ($\beta = .29$, $p < .001$) predicted behavior changes. Target group- and behavior-specific intervention components are as important for changes in intentions and behavior as components derived from common health behavior theories.

N. Schüz · M. Eid
Department of Education and Psychology,
Methods and Evaluation, Freie Universität Berlin,
Berlin, Germany

N. Schüz (✉)
Centre of Research Excellence for Chronic
Respiratory Disease, School of Medicine,
University of Tasmania, Private Bag 23,
Hobart, TAS 7001, Australia
e-mail: natalie.schuez@utas.edu.au

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Introduction

Tall and tan and young and lovely—these attributes were once bestowed upon the famous girl from Ipanema whose stunning appearance left everyone speechless (Jobim & de Moraes, 1962). A tan is a beauty ideal a majority of Caucasian teenagers share with the authors of this song (Broadstock et al., 1992). At the same time, sun exposure during adolescence is associated with an increased risk for melanoma and other types of skin cancer in later life, as children and adolescents are particularly vulnerable to UV radiation (Whiteman et al., 2001). Furthermore, teenagers are the age group that tends to pay the least attention to appropriate sun protection measures, while spending the highest amount of time in the sun (Brown et al., 2006; Stanton et al., 2004). Taking into consideration the dramatic increase in melanoma prevalence worldwide (Linos et al., 2009), there is great need for interventions influencing teenage sun exposure. However, a systematic review revealed that evidence for determining the effectiveness of such interventions is insufficient (Saraiya et al., 2004). In recent years, individual-oriented (e.g., Olson et al., 2007; Reynolds et al., 2006; White et al., 2010) and environmental (e.g., Dobbinson et al., 2009; Emmons et al., 2008) approaches to sun protection interventions for teenagers have been introduced. However, there are only very few studies evaluating school-based interventions derived from theoretical models (e.g., Reynolds et al., 2006; White et al., 2010). Most previous studies lack a clear theoretical background, which complicates the interpretation of results (Michie & Abraham, 2004), and lack target-group specific contents of the interventions.

Determinants of adolescent sun exposure: health behavior theory

In order to be able to evaluate *how* interventions bring about behavior change, it is indispensable to base intervention components on theory, so that one is able to test the mechanisms of change as prescribed by the theoretical model. For this purpose, one should examine whether the intervention has led to any changes in intermediating variables at a later point in time which in turn led to changes in intention and behavior. Health behavior theories delineate a parsimonious set of predictors for behavior. There is a considerable overlap between the constructs of different social cognition theories (Armitage & Conner, 2000; Weinstein, 2003). The Theory of Planned Behavior (TPB; Ajzen, 1985), Protection Motivation Theory (PMT; Rogers, 1975) and the Health Action Process Approach (HAPA; Schwarzer, 2008) incorporate three major predictors of intentions: expectations about the consequences of a health or risk behavior (outcome expectancies), beliefs about one's competency to be able to perform the behavior in the face of difficulties (self-efficacy), and beliefs about the threat to one's health entailed in a risky behavior (risk perception). Previous studies on sun protection have confirmed the importance of these three factors in the prediction of protection intentions (Craciun et al., 2012; Jackson & Aiken, 2006; Myers & Horswill, 2006; Van Osch et al., 2008). In addition to these predictors, the TPB includes beliefs about subjective norms as a predictor of intention. However, subjective norms are generally found to be only a weak predictor of intention (Armitage & Conner, 2001), and studies on sun protection reconfirm this general finding (e.g., Myers & Horswill, 2006; Van Osch et al., 2008).

Determinants of adolescent sun exposure: target group-specific

As these health behavior theories were constructed to be parsimonious and valid for various different health behaviors, determinants specific to certain behaviors or target groups are not accounted for. Evidence from previous studies suggests that *peer influence*, *impulsivity*, and *appearance motives* have a strong effect on adolescent health behavior in general and sun exposure in particular (Broadstock et al., 1992; Romer 2010; Wichstrøm 1994). In addition to the three factors derived from health behavior theories (risk perception, outcome expectancies, and self-efficacy), these three further factors may explain additional variance in adolescent sun protection intentions and behavior. Therefore, they are briefly described below.

Peer Influence (prototype evaluation)

The Prototype Willingness Model (Gibbons & Gerrard, 1995) assumes that during adolescence, the peer group largely influences decision-making. Studies on sun protection have identified that peer behavior affects both, sunbathing and sunscreen use (Paul et al., 2008; Wichstrøm, 1994). Positive or negative evaluations of a prototypical peer (e.g., the prototypical tanner) were shown to predict the willingness for adolescent risk behaviors such as smoking and drinking (Gerrard et al., 2008), as well as UV exposure (Gibbons et al., 2005).

Impulsivity (health-related time perspective)

Health-related time perspective (i.e., preferring short-term outcomes over long-time health benefits) plays an important role in health-related behavior regulation (Hall & Fong, 2003). Teenagers are at the peak of their health and the prospect of a decreasing health in adulthood might seem very far away. Thus, motivating them to perform a health behavior that might only bear fruit during late adulthood in terms of disease prevention seems difficult. Health-related time perspective can be taken as an indicator of impulsivity, which peaks during adolescence and is directly related to risk behavior (Romer, 2010). Therefore, teenagers' time perspective might be an important predictor of deliberate sun exposure in this age group. Hall and Fong (2003) have shown that a time perspective intervention effectively increases young adults' physical activity levels. From a practical point of view, time perspective may be easier to target than more personality-related indicators of impulsivity such as sensation-seeking.

Appearance motives

Risk behavior such as sun overexposure can be highly functional during adolescence. A majority of Caucasian teenagers indicate that tanned skin increases attractiveness (Broadstock et al., 1992). Indeed, increased attractiveness and impression management are two of the reasons adolescents give for sun exposure (Paul et al., 2008). While a positive evaluation of a prototypical peer who tans a lot refers to norms of what is accepted in the peer group, appearance motives for tanning rather pertain to an individual's subjective belief about whether or not tanning increases attractiveness. Several intervention studies conducted with college students show that interventions targeting appearance motives are effective in changing sun protection attitudes, intentions, or behavior (e.g., Hillhouse & Turrisi, 2002; Jackson & Aiken, 2006; Mahler et al., 2006, 2007). While studies examining the effectiveness of school-based interventions indicate that including an

appearance component can influence intentions to use sunscreen and sun protective behavior (Olson et al., 2007, 2008), evidence concerning the intermediating variables that may produce these changes is still missing.

Very few studies so far evaluate theory-based interventions targeting sun protection in the school context. Most of these do not account for factors that are important for the specific target group and behavior but restrict themselves to testing the parsimonious framework of a particular theory. The two studies in this article systematically integrate health behavior theory and evidence-based predictors to identify the relevant determinants of sun protection intentions and behavior in adolescents (Study 1). Study 2 is the first to test the role of this specific set of predictors in a comprehensive school-based intervention employing a randomized controlled trial with a placebo-intervention control group. Accordingly, the studies provide information on the most important predictors of adolescent sun protection and how to target these effectively in a school-based intervention.

Aims and hypotheses

This study has two major aims: In a first step (Study 1), it aims to determine the relative effects of predictors of adolescent sun exposure that go beyond the determinants derived from common health behavior theories. As suggested by social cognition models, we hypothesize that risk perception, outcome expectancies and self-efficacy predict intention, while intention is the strongest predictor of behavior. Additionally, it is assumed that prototype evaluation, time perspective, and appearance motives incrementally affect intention and behavior. In a second step (Study 2), it is aimed to evaluate the effectiveness of an intervention based on the effective predictors identified in Study 1, and to evaluate whether changes in these predictors caused by the intervention affect adolescent sun protection intentions and behavior. More specifically, it is hypothesized that the intervention leads to changes in the predictors identified in Study 1, and that these changes predict changes in sun protection intentions and behavior.

Method—study 1

Participants and procedure

The total sample for this cross-sectional study comprised 156 high school students between 15 and 18 years ($M = 15.73$, $SD = 0.66$), 55.1 % of which were female students. Data were assessed during class hours in eight classes based in four different schools during summer. Inclusion criteria were sufficient knowledge of the German language and informed consent from each student. Approval for the study was given by each head of school and by the Berlin Senate Administration for Education, Science and Research.

Measures

All items except intention and risk perception were measured on a 4-point Likert scale (1 = totally disagree to 4 = totally agree). Self-efficacy, outcome expectancies, risk perception and intention were assessed according to Schwarzer (2008), and adapted to sun exposure. Factor analyses confirmed the unidimensionality of the items for each scale, and scales were computed by taking the mean score of the items. Table 1 provides an overview of descriptive statistics for the study variables.

Sun exposure behavior was measured with two items taken from Eid (1997): "When the sun was shining, I tried to get as tanned as possible" and "When the sun was shining, I often went outside in order to get a tan" (Cronbach's $\alpha = .83$).

Intention to avoid overexposure to the sun was measured with two items on a 5-point Likert scale (1 = do not intend at all, 5 = strongly intend): "I intend to avoid the midday sun" and "I intend to avoid deliberate tanning" (Cronbach's $\alpha = .50$).

Risk perception was measured with two items: "How high is the likelihood of you getting skin cancer?" and "Compared to an average student of your age and sex, how high is the likelihood of you getting skin cancer?" (1 = very unlikely, 5 = very likely, Cronbach's $\alpha = .74$).

Outcome expectancies were measured with three items: Avoiding overexposure to the sun… "… decreases the risk for skin cancer", "… decreases the risk for sunburn", and "… protects from premature aging" (Cronbach's $\alpha = .64$).

Self-efficacy for avoiding overexposure was measured with a single item: "I am confident that I can stay in the shade even when most of my friends don't."

Health-related time perspective was measured with three items: "Long term health is more important to me than having as much fun as possible", "I don't abstain from fun just because it might hazard my health in the long term" (reverse coded) and "I live life to the fullest, even at the cost of poor health" (reverse coded, Cronbach's $\alpha = .70$).

Appearance motives were assessed with three items of the Physical Appearance Reasons for Tanning Scale (Cafri et al., 2006) such as: "I tan because it makes me more attractive" (Cronbach's $\alpha = .64$).

Prototype evaluation was assessed according to Gibbons & Gerrard (1995): Students were asked to think of a typical person of their age who frequently tans, and were then asked how they evaluate this person, using the following adjectives: attractive, cool, popular (Cronbach's $\alpha = .75$).

Table 1 Correlations among model constructs for study 1 (upper diagonal) and study 2 (lower diagonal)

Variable	1	2	3	4	5	6	7	8	*M*	*SD*
1. Sun exposure behavior	–	.27**	−.02	.12	.27**	−.15	.54**	.10	2.69	0.95
2. Intentions to avoid overexposure	.35**	–	.20*	.13	.34**	.28**	−.20*	−.16	2.44	1.04
3. Risk perception	−.07	.13*	–	.18*	.10	.16	.02	−.03	2.92	0.68
4. Outcome expectancies	.08	−.03	−.07	–	.02	.03	.22**	.12	2.89	0.69
5. Self-efficacy	−.17*	.53**	.07	−.06	–	.17*	.23**	−.14	2.41	1.04
6. Time perspective	.03	.30**	−.02	.13	.26**	–	−.19*	−.15	2.81	0.64
7. Appearance motives	.56**	.31**	−.08	.12	−.14*	.11	–	.33**	2.03	0.66
8. Prototype evaluation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	–	1.97	0.76
M	2.48	2.61	2.33	3.09	2.09	2.51	2.48	n/a		
SD	0.84	0.92	0.62	0.62	0.83	0.63	0.82	n/a		

Means and Standard Deviations for Study 1 are presented in the vertical columns, Means and Standard Deviations for Study 2 are presented in the horizontal rows

* $p < .05$, ** $p < .01$. Longitudinal correlations for Study 2 are available upon request

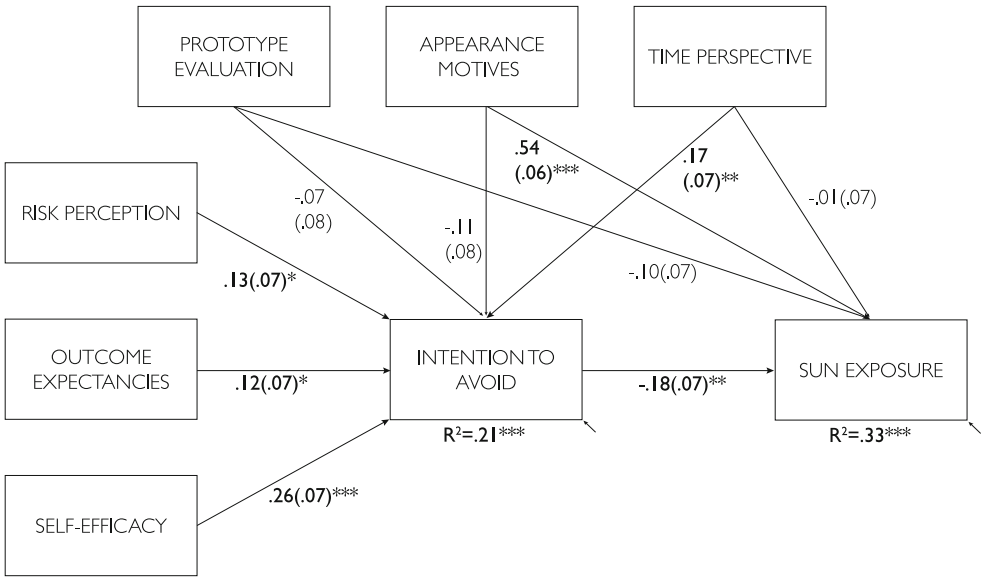


Fig. 1 Path model of sun exposure and intentions to avoid overexposure. All parameter estimates are standardized. *Standard errors* are given in *parentheses*. Correlations among the variables are presented in Table 1. ***$p < .001$, **$p < .01$, *$p < .05$

Analytical procedure

The relations between the theory- and evidence-based predictors, intention and exposure behavior were tested in a path model in Mplus 5.2 (Muthén & Muthén, 1998–2007).

Multilevel structure of the data

Since students were nested in classes, the hierarchical structure of the data could lead to an underestimation of standard errors. The intraclass correlation (ICC) provides an estimate of the dependency of observations. With an estimate of .006, the ICC for exposure behavior was extremely low, therefore it was not considered to be necessary to correct standard errors.

Results

Figure 1 shows the complete model. Model fit was excellent, $\chi^2(3) = 3.24$, $p = .36$, RMSEA = .02, CFI = 1.00 (all *p*-values refer to one-sided tests). Self-efficacy, health-related time perspective, risk perception and outcome expectancies predicted intention to avoid overexposure. Participants with a longer time perspective reported higher protection intentions. Prototype evaluation and appearance motives had no direct influence on intention. Intention to avoid overexposure predicted behavior; however, the largest part of behavioral variance was explained by appearance motives. Time perspective and prototype evaluation were not significant predictors of exposure behavior. Overall, the amount of variance explained in exposure behavior was high with a multiple correlation of $R = .57$. Prototype evaluation

was the only predictor in the model that neither predicted intention nor behavior.

Discussion

Study 1 explored the relationship of theory-based and target group-specific predictors to intentions to avoid overexposure and sun exposure behavior. The path model showed that self-efficacy, time perspective, risk perception, and outcome expectancies predicted intention while appearance motives and intention predicted behavior. This suggests that these additional factors indeed play a role in explaining adolescent sun protection behavior. Health-related time perspective predicted the intention to protect oneself. This is remarkable insofar as this is a very general measure, asking for the willingness to make concessions in the present like abstaining from fun in order to stay healthy in the future. Appearance motives correlated stronger ($r = .54$) with exposure behavior than intention ($r = .27$), which by many theories is considered to be the most important determinant of behavior (e.g., Ajzen, 1985). Yet, appearance motives did not predict avoidance intentions. Prototype evaluation was the only predictor in the model that neither predicted intention nor behavior. Although the cross-sectional and correlational design of Study 1 does not allow for any causal interpretations, the identified predictors can inform further work, in particular intervention studies, and were therefore targeted in Study 2.

Study 2

Study 1 provided evidence for the usefulness of adding additional factors to predictors derived from health behavior theories in predicting adolescent sun exposure. Study 2 therefore targeted the identified effective predictors in a school-based RCT.

Method

Study design

This study was conducted as a randomized controlled trial with three points of measurement. The trial employed a nonspecific control group design (Jacobson & Baucom, 1977), in which the control condition was exactly matched to the sun protection intervention but targeted a different health behavior: interdental hygiene. This allows controlling for experimenter-specific and stylistic effects such as the involvement of the person delivering the program, the amount of attention towards participants, the participant involvement and the structure of the program. This is a superior test of effectiveness than the comparison of the treatment to an attention or wait-list control group (Jacobson & Baucom, 1977; Lohr et al., 2003).

Pretest, intervention and immediate posttest were carried out on the same day in a block of two 45-min sessions, the follow-up took place 5–8 weeks later.

Participants and procedure

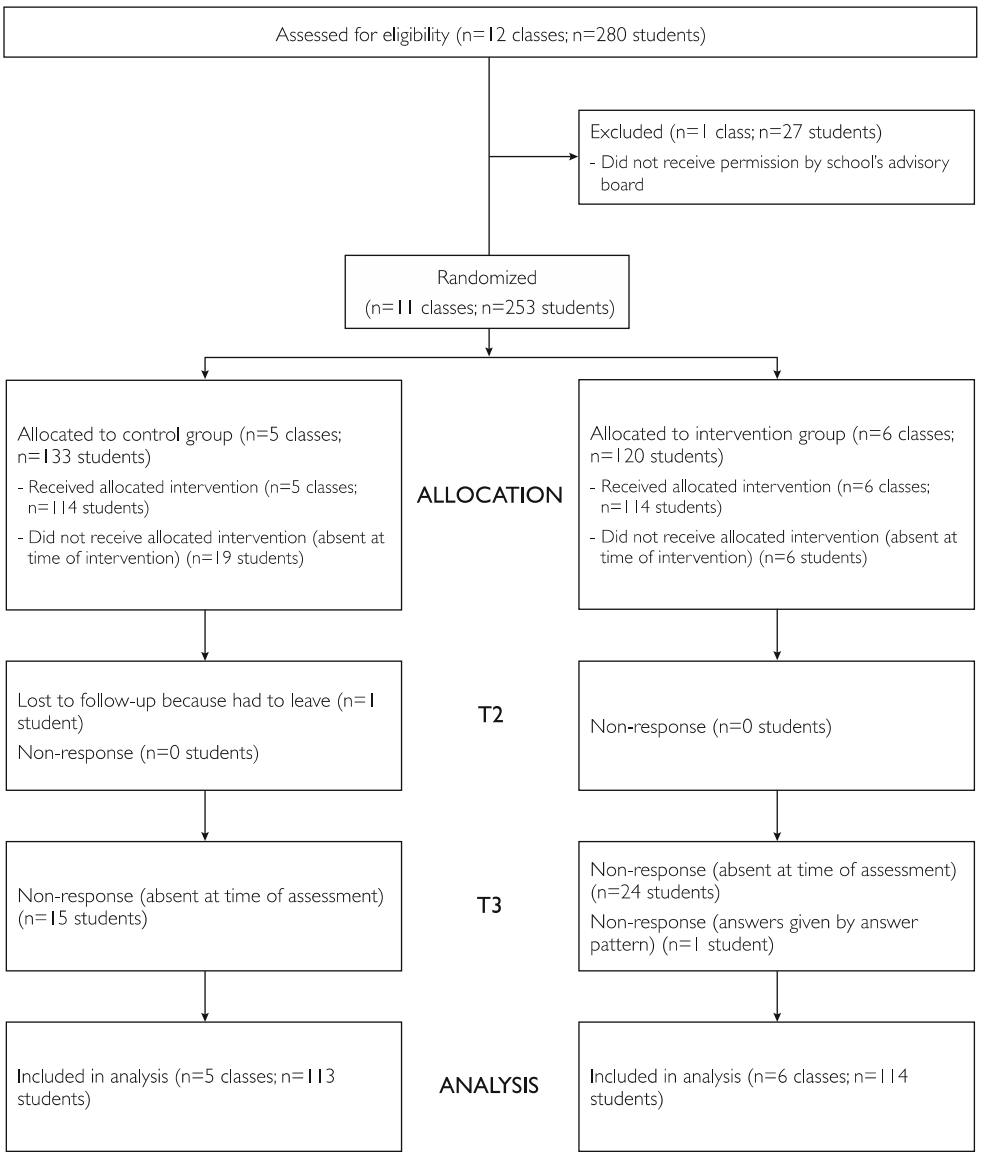
The study was conducted in seven high schools during the summer. The schools were based in three different administrative districts in the federal state of Brandenburg, Germany. Gross domestic product (GDP) per capita in these districts was 23,098US$, 31,939US$, and 44,138US$, respectively. The average GDP per capita in Germany in 2010 was 43,842US$, the average GDP per capita in the federal state in which data were assessed was more than 12,000US$ below the German average (Statistisches Bundesamt, 2010). The final sample consisted of 253 students with a mean age of 14.32 years (range 13–19), 50.9 % of which were female students. Figure 2 presents an overview of participant flow through the study. Inclusion criteria were sufficient knowledge of the German language and informed consent from each student and a guardian. Both the schools' advisory boards and the Brandenburg Ministry of Education approved the trial (WU 07/2009). The intervention and all assessments were conducted during class hours. The same staff implemented all intervention sessions, thus ensuring strict adherence to the delivery protocol. Randomization took place on class level. Classes were allocated to one of the two experimental conditions according to a computer-generated list of random numbers. Five classes were allocated to the control group, six classes were allocated to the intervention group.

Sun protection intervention

The sun protection intervention consisted of a 45-min interactive presentation addressing self-efficacy, outcome expectancies, risk perception, appearance motives, and health-related time perspective plus general information about positive and negative effects of sun exposure, skin types, skin cancer, premature aging, and instructions on how to perform sun protection. In addition to the presentation, each participant received a printout of a personal UV photo depicting UV damage (Mahler et al., 2005).

Risk perception towards skin cancer and premature aging was addressed by providing information about the negative consequences of sun overexposure and epidemiological data for skin cancer. Additionally, risk feedback

Fig. 2 Participant flowchart



was tailored to the target group by explaining that adolescent skin is more vulnerable to UV rays. *Positive outcome expectancies* for avoiding overexposure were addressed by discussing immediate advantages of sun protection, such as avoiding sunburn, as well as more distal advantages such as avoiding skin cancer and premature skin aging. After peer exposure behavior was identified as a possible barrier for avoiding overexposure, *self-efficacy* beliefs were targeted by developing arguments to convince friends to seek a shaded area, such as telling them that it is too hot or bright in the sun. *Appearance motives* were addressed by providing normative information about appearance trends. Title pages of fashion magazines from the 1970s and 1980s, which depicted models with unnaturally dark skin were compared to current cover pages from the same magazines. The point was made that fashion designers in recent years preferred working with more natural looking models and that there is an ongoing trend towards more naturalness. Furthermore, two pictures of well-known celebrities were shown. The first picture showed the celebrity with extremely tanned skin and the second with natural skin color. Students were asked whether they agreed that the natural pictures looked better and indicated by hand signal that this was true.

UV photographs

Health-related time perspective was addressed via UV photographs. Photographs were taken with a single-lense reflex camera with two external flashes equipped with UV emission filters (Fabrizi et al., 2008). Photos were additionally processed in an Adobe Photoshop® routine to

improve detection of sun-damaged skin areas. UV photographs were taken and processed while students were filling in the baseline questionnaire. Photographs were printed on-site and handed out as part of the last intervention block. Before receiving the photographs, students were instructed that UV photographs visualize damage caused by overexposure to the sun, which may later appear in the form of wrinkles, age spots, and sometimes skin cancer. Furthermore, students were instructed on how to interpret their photograph and were told that any dark spots not visible under normal light are indicative of skin damage (cf. Mahler et al., 2010).

Nonspecific control group: interdental hygiene

The control intervention was completely parallel to the sun protection intervention; a 45-min interactive presentation addressed the same study constructs with regard to interdental hygiene. UV photographs were employed to visualize plaque levels on the teeth. Risk perception was addressed by providing information about the negative consequences of improper dental hygiene. Outcome expectancies were addressed by discussing positive consequences of flossing. Self-efficacy beliefs were tackled by practicing the correct use of floss. Showing pictures of celebrities with good or bad teeth addressed appearance norms.

Measures

Primary outcomes of the study were changes in the intention to avoid overexposure to the sun and changes in exposure behavior. In both, the intervention and the control groups, all measures were completed in the same order. All variables were measured at baseline (T1), the social cognitive variables and intentions were again assessed at immediate follow-up (T2) and exposure behavior was measured 5–8 weeks after the intervention (T3). The measures used in Study 2 were the same as those in Study 1 with a few exceptions listed below. Table 1 provides an overview of the descriptive statistics.

Sun exposure behavior was measured with the items described in Study 1, Cronbach's α (T1/T3) = .70/.72.

Intention to avoid overexposure to the sun. An additional third item was used to measure intentions: "I intend to stay in the shade when I am outside" (Cronbach's α (T1/T2) = .70/.80).

Risk perception. A third item was added to measure risk perception: "How high is the likelihood of an average student of your age and sex for getting skin cancer?" (Cronbach's α (T1/T2) = .70/.84).

Outcome expectancies were measured with the same items as in Study 1 (Cronbach's α (T1/T2) = .65/.80).

Self-efficacy was measured with the same items as in Study 1, the re-test reliability between T1 and T2 was $r = .54$.

Health-related time perspective was measured with three items: "Long term health is more important to me than having as much fun as possible", "I practice abstinence from certain things because my health is important to me", and "I try to keep my good health and abstain from things that might do harm" (Cronbach's α (T1/T2) = .70/.77).

Appearance motives were assessed with three items: "I tan because it make me more attractive", "My skin looks better if I am tanned", and "I feel healthier if I am tanned" (Cronbach's α (T1/T2) = .86/.88).

Analyses

The path model tested in Study 2 was informed by the results of Study 1 (Fig. 1). A path model allows for simultaneously testing intervention effects on mediators, intentions and behavior, which is not possible in ANOVA-based approaches. Analyses were conducted using Mplus Version 5.2 (Muthén & Muthén, 1998–2007). Paths identified as negligible in Study 1 were not tested in the analysis. All analyses controlled for baseline measures.

Multilevel structure of the data

Both the ICC for sun protection intentions at baseline and the ICC for behavior at baseline and follow-up were zero, thus the multilevel structure was deemed negligible.

Dropout analyses

There was no differential attrition across experimental groups, Cramer's $V = .12$, $p = .08$. There were no differences on any of the study variables between retained and dropped-out participants, Pillai's Trace = 0.024, $F(8, 205) = 0.64$, $p = .75$, $f^2 = .02$. Retained participants did not differ in age from drop-outs, $t(217) = 0.65$, $p = .52$, Cohen's $d = 0.12$.

Randomization checks

Students in the two conditions did not differ in age, $t(188.73) = -1.85$, $p = .07$, Cohen's $d = 0.25$, sex, Cramer's $V = .00$, $p > .999$, nor skin type, $\chi^2 = 4.60$, $p = .33$. A MANOVA revealed no significant baseline differences on any of the study variables between the two experimental groups, Pillai's Trace = 0.05, $F(8, 205) = 1.29$, $p = .25$, $f^2 = .05$.

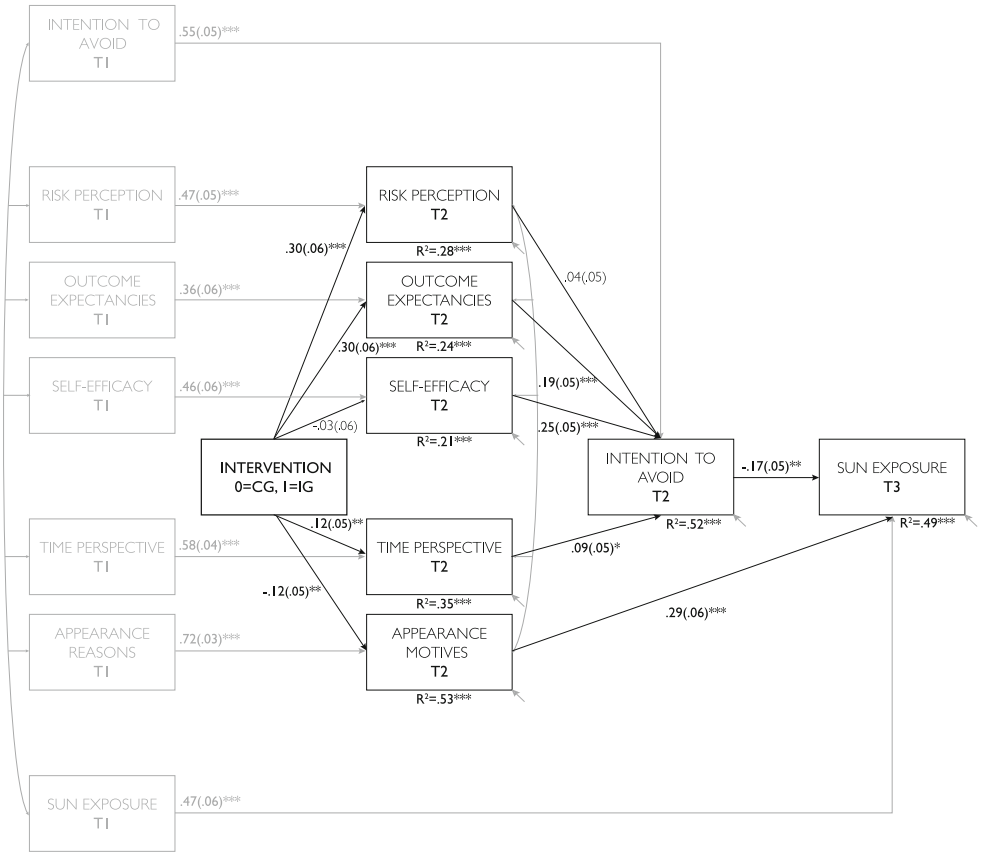


Fig. 3 Path model of the intervention study. All parameter estimates are standardized. *Standard errors* are given in *parentheses*. T1 correlations are presented in Table 1. ***$p < .001$, **$p < .01$, *$p < .05$

Results

The first aim of the study was to test the effectiveness of the intervention in changing the intervention components (Fig. 3).[1] Model fit was acceptable with $\chi^2(49) = 101.17$, $p < .001$, CFI = .94, RMSEA = .065, SRMR = .05. Being in the intervention group predicted considerable changes in risk perception and outcome expectancies. The intervention also caused changes in health-related time perspective and appearance motives. Participants in the intervention group not only reported a longer time perspective but also less appearance reasons for tanning at immediate follow-up. There were no changes in self-efficacy.

The second aim of the study was to examine the importance of changes in the intervention components for predicting changes in sun avoidance intentions and exposure behavior. Changes in self-efficacy, outcome expectancies and health-related time perspective predicted changes in intention, while risk perception was no significant predictor. Changes in intention and changes in appearance motives predicted changes in exposure behavior.

[1] All p-values refer to one-sided tests due to directed hypotheses.

Discussion

The intervention changed risk perception and perceived advantages of sun protection. Furthermore, participants in the intervention group reported a longer health-related time perspective and lower appearance motives than the control group. Besides risk perception, changes in these determinants significantly predicted changes in intention to avoid overexposure and changes in exposure behavior. This underlines the idea that target-group specific components enhance the effectiveness of interventions for high-risk groups such as adolescents.

General discussion

The two studies in this paper examined the effectiveness of target-group specific factors in addition to factors derived from health behavior theories in changing sun protection behavior in a high-risk group, namely adolescents. Study 1 showed that health-related time perspective and appearance motives predicted intentions and behavior in addition to health behavior theory factors. Study 2 translated these

findings into practice and evaluated a comprehensive school-based health promotion intervention for teenagers. Moreover, it offered experimental proof for the meaningfulness of these factors in the behavior change process. Previous studies have examined social-cognitive mediators of the effects produced by appearance-based interventions on intentions and behavior among college students. For example, Jackson and Aiken (2006) showed that changes in image norms changed intentions to avoid sunbathing. Mahler et al. (2007) found that changes in perceived susceptibility to photoaging caused changes in intentions. Similarly, Gibbons et al. (2005) found that an appearance-based intervention effected changes in subsequent attitudes and perceived vulnerability which partially mediated the intervention effects on tanning booth use. Our studies corroborate these findings, but go beyond previous studies in combining the evidence in a comprehensive framework pre-tested in a correlational study (Study 1) and translated into practice in a school-based RCT (Study 2). This adds to the limited evidence-base for the effectiveness of theory-based interventions targeting UV overexposure in teenagers, an important target group for skin cancer prevention (Saraiya, et al., 2004). At the same time, employing a nonspecific control group design allowed to control for non-specific effects of the intervention such as formal aspects, experimenter effects, or attention.

Intervention components—health behavior theory

Study 1 showed that risk perception, outcome expectancies, and self-efficacy were important predictors of intentions and behavior. In the intervention, information on the negative consequences of overexposure and vulnerability feedback effectively targeted risk perception. Discussing positive consequences of sun protection targeted positive outcome expectancies. The path analysis accordingly revealed significant effects of the intervention on changes in risk perception and outcome expectancies, and changes in outcome expectancies affected changes in intention. However, there were no intervention effects on changes in self-efficacy. A meta-analysis (Ashford et al., 2010) found that barrier identification is not as effective in changing self-efficacy as feedback on past performance or vicarious experience, which might be responsible for this lack of an effect.

While risk perception was an important predictor of intention in Study 1, Study 2 found no effects of risk perception on changes in intention. This corroborates findings of previous studies (Craciun et al., 2012) and does not necessarily contradict theory. For example, in the HAPA, risk perception is conceptualized as a distal predictor of intention that serves to stimulate outcome expectancies (Schwarzer, 2008).

It needs to be noted that the intervention consisted of multiple components, therefore it is not possible to identify which component was responsible for producing changes in each of the predictors or whether there was a synergistic effect of all components working together.

Intervention components—prototype evaluation, time perspective, and appearance motives

Prototype evaluation

Study 1 showed that prototype evaluation was not related to avoidance intention or exposure behavior. This could be explained by the conceptualization of prototype evaluation in the Prototype/Willingness Model (PWM; Gibbons & Gerrard, 1995), where it predicts *behavioral willingness* rather than behavior. The PWM suggests a dual processing approach with a rational, controllable form of planned engagement in a behavior (i.e., intention) and a more impulsive, uncontrollable *willingness* to engage in a behavior. As our studies assessed intentions following the expectancy-value approach predominant in social cognitive theories (Ajzen, 1985), our study might have underestimated the effect of prototype evaluation as a distal determinant of behavior in that it influences behavioral willingness which in turn affects behavior (Gibbons et al., 2009).

Time perspective

While time perspective is often conceptualized as a stable individual difference measure (Strathman et al., 1994), previous intervention studies were able to change time perspective (Hall & Fong, 2003) by providing short-term benefits of health behavior. Study 2 tried a different approach by providing teenagers with a UV photograph of their face showing skin damage, which will only be visible in the future. This might affect how they think about their current risk behavior and their future health. The path analysis shows that being in the intervention group predicted changes in health-related time perspective, and that these changes affected changes in the intention to avoid sun exposure.

A recent study by Hall et al. (2012) provides first evidence that the effect of time perspective on behavior is mediated by intention strength. The two studies in this article corroborate this finding by showing that time perspective affects intention rather than behavior. This finding might also explain why previous studies employing UV photographs found good evidence for their effectiveness in changing sun protection intentions, while evidence for behavior change is limited (Hollands et al., 2010; Mahler et al., 2007; Olson et al., 2008).

Appearance motives

While some authors conceptualize appearance motives to be a positive attitude or outcome expectancy, which is a predictor of intention but not behavior (Cafri et al., 2006; Jackson & Aiken, 2000), Study 1 showed a strong effect of appearance motives on behavior. This is remarkable insofar as intention is usually the strongest predictor of behavior. Furthermore, health behavior theories such as the TPB or the HAPA assume the effect of attitudes on behavior to be completely mediated by intentions. In the intervention, visualizing the ongoing social trend towards a natural instead of a tanned appearance targeted appearance motives, and the path analysis revealed a substantial effect of appearance motives on exposure behavior. These effects could be due to the specific population in our studies: Broadstock et al. (1992) showed that a majority of adolescents considers tanned skin to look healthy and attractive. At the same time, studies show that attractiveness increases popularity in the peer group (Becker & Luthar, 2007). Therefore, adolescents might have particularly strong social motives to obtain a tanned appearance. To our knowledge, however, there so far exist no studies comparing mean levels of adolescent and adult appearance reasons for tanning or whether the importance of appearance reasons for the prediction of intention and behavior differs between teenage and adult populations.

Limitations and ideas for future research

This study tested the importance of three behavior- and target-group specific predictors of adolescent sun exposure in the framework of health behavior theories such as the HAPA. This was done in a correlational as well as in an experimental study. However, as all intervention components were tested at the same time, it is impossible to draw conclusions about the effectiveness of any single component for changing behavior. Future studies might want to test whether UV photographs alone lead to changes in health related time perspective, for example. Furthermore, it is possible that the observed changes in appearance motives were not entirely due to the intervention component addressing this construct but were also due to the UV photographs. Thus, in order to disentangle the effects of each intervention component presented in Study 2, future studies should test each component separately. It is possible that some intervention components were actually superfluous (e.g., those targeted at changing risk perception) and could be left out in future interventions. Furthermore, we did not test for any moderator effects. Prototype evaluation, for example, could be conceptualized as a moderator of the self-efficacy-intention relation. Thus, it might not be important as a direct predictor of intention, but it might still be consequential to address prototype evaluation in an intervention, as it might increase the likelihood that high self-efficacy beliefs indeed lead to higher intentions. Moreover, in order to be able to determine the long-term effectiveness of the intervention, a longer behavioral follow-up would have been preferable. However, the ideal time point for a long-term follow-up is not easily calibrated in this case as sun protection behavior in Germany can only be validly assessed during three months of the year. Therefore, it is suggested to evaluate the intervention in countries at lower latitudes in order to be able to assess follow-ups between three and twelve months.

The fact that self-efficacy was measured as a single-item measure in both studies is a limitation that needs to be addressed. Single item scales lack reliability, which makes it difficult to interpret the results obtained for self-efficacy. Thus, the absence of an intervention effect on self-efficacy might be interpreted to be either due to the unreliable assessment of self-efficacy or to the intervention's failure to properly address self-efficacy. Considering the relative importance of self-efficacy for producing changes in intentions, future studies want to include more items for the scale. Additionally, time perspective was assessed in relation to health. Therefore, the scale used in the two studies differs from existing, more general measures, which makes it difficult to embed the current results into previous research. However, the way time perspective was conceptualized in the two studies has the benefit of making it more relevant to the behavior change process. The behavioral outcome measure used in this study assessed the habitual aspect of sun exposure rather than the exact frequency of sun exposure. Frequency measures are of limited value in this case as the time spent in the sun is unlikely to be recalled accurately across a timespan of up to two months. Ideally, additional methods for measuring sun exposure should be employed to demonstrate the reliability of the habitual measure used in the two studies. Diary methods or ecological momentary assessment will reflect actual behavior with greater precision.

Furthermore, there is good empirical evidence for postintentional mediators of the intention-behavior relation such as action planning, coping planning, and action control (Schwarzer, 2008), which might be worthwhile targets for further studies examining the relations between these mediators and the supplementary factors introduced here.

There are specific strengths of our studies. Both studies targeted an important high-risk group in skin cancer prevention, namely adolescents, and for the first time targeted both factors from health behavior theory as well as target-group and behavior-specific factors in a school-based intervention. Study 2 provided a test for the effectiveness of a sun protection intervention by employing a parallel

design for the two experimental groups. This allows interpreting all effects in the experimental groups as directly caused by the intervention.

Implications

The results of our studies imply that target group- and behavior-specific factors should be included in health behavior interventions, as these might explain additional variance in intention and behavior over and above the variance explained by the standard predictors incorporated in health behavior theories. Adolescent sun exposure has previously been identified to be a major concern for health intervention programs. Our studies provide a strong evidence-base for the practicability and effectiveness of a short school-based intervention program targeting this special risk population. Taken that the intervention encompassed one 45-min session only, this might be a viable way to improve health promotion in such important target groups.

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References

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11–39). Heidelberg: Springer.

Armitage, C. J., & Conner, M. (2000). Social cognition models and health behaviour: A structured review. *Psychology & Health, 15*, 173. doi:10.1080/08870440008400299

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology, 40*, 471–499. doi:10.1348/014466601164939

Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology, 15*, 265–288. doi:10.1348/135910709x461752

Becker, B. E., & Luthar, S. S. (2007). Peer-perceived admiration and social preference: Contextual correlates of positive peer regard among suburban and urban adolescents. *Journal of Research on Adolescence, 17*, 117–144. doi:10.1111/j.1532-7795.2007.00514.x

Broadstock, M., Borland, R., & Gason, R. (1992). Effects of suntan on judgments of healthiness and attractiveness by adolescents. *Journal of Applied Social Psychology, 22*, 157–172. doi:j.1559-1816.1992.tb01527.x

Brown, T. T., Quain, R. D., Troxel, A. B., & Gelfand, J. M. (2006). The epidemiology of sunburn in the US population in 2003. *Journal of the American Academy of Dermatology, 55*, 577–583. doi:10.1016/j.jaad.2006.05.029

Cafri, G., Thompson, J. K., Roehrig, M., van den Berg, P., Jacobsen, P. B., & Stark, S. (2006). An investigation of appearance motives for tanning: The development and evaluation of the physical appearance reasons for tanning scale (PARTS) and its relation to sunbathing and indoor tanning intentions. *Body Image, 3*, 199–209. doi:10.1016/j.bodyim.2006.05.002

Craciun, C., Schüz, N., Lippke, S., & Schwarzer, R. (2012). A mediator model of sunscreen use: A longitudinal analysis of social-cognitive predictors and mediators. *International Journal of Behavioral Medicine, 1*, 65–72. doi:10.1007/s12529-011-9153-x

Dobbinson, S. J., White, V., Wakefield, M. A., Jamsen, K. M., Livingston, P. M., English, D. R., et al. (2009). Adolescents' use of purpose built shade in secondary schools: Cluster randomised controlled trial. *British Medical Journal, 338*, 6. doi:10.1136/bmj.b95

Eid, M. (1997). Sonnenschutzverhalten: Ein typologischer Ansatz (Sun protection behavior: A typological approach). *Zeitschrift für Gesundheitspsychologie, 5*, 73–91.

Emmons, K. M., Geller, A. C., Viswanath, V., Rutsch, L., Zwirn, J., Gorham, S., et al. (2008). The SunWise policy intervention for school-based sun protection: a pilot study. *Journal of School Nursing, 24*, 215–221. doi:10.1177/1059840508319627

Fabrizi, G., Pagliarello, C., & Massi, G. (2008). A simple and inexpensive method for performing ultraviolet photography in your dermatology practice. *Dermatologic Surgery, 34*, 1093–1095. doi:10.1111/j.1524-4725.2008.34217.x

Gerrard, M., Gibbons, F. X., Houlihan, A. E., Stock, M. L., & Pomery, E. A. (2008). A dual-process approach to health risk decision making: The prototype willingness model. *Developmental Review, 28*, 29–61. doi:10.1016/j.dr.2007.10.001

Gibbons, F. X., & Gerrard, M. (1995). Predicting young adults' health risk behavior. *Journal of Personality and Social Psychology, 69*, 505–517. doi:10.1037/0022-3514.69.3.505

Gibbons, F. X., Gerrard, M., Lane, D. J., Mahler, H. I. M., & Kulik, J. A. (2005). Using UV photography to reduce use of tanning booths: a test of cognitive mediation. *Health Psychology, 24*, 358–363. doi:10.1037/0278-6133.24.4.358

Gibbons, F. X., Houlihan, A. E., & Gerrard, M. (2009). Reason and reaction: The utility of a dual-focus, dual-processing perspective on promotion and prevention of adolescent health risk behaviour. *British Journal of Health Psychology, 14*, 231–248. doi:10.1348/135910708x376640

Hall, P. A., & Fong, G. T. (2003). The effects of a brief time perspective intervention for increasing physical activity among young adults. *Psychology & Health, 18*, 685–706. doi:10.1080/0887044031000110447

Hall, P. A., Fong, G. T., & Cheng, A. (2012). Time perspective and weight management behaviors in newly diagnosed Type 2 diabetes: A mediational analysis. *Journal of Behavioral Medicine*. Advance online publication. doi:10.1007/s10865-011-9389-6

Hillhouse, J. J., & Turrisi, R. (2002). Examination of the efficacy of an appearance-focused intervention to reduce UV exposure. *Journal of Behavioral Medicine, 25*, 395–409. doi:10.1023/A:1015870516460

Hollands, G. J., Hankins, M., & Marteau, T. M. (2010). Visual feedback of individuals' medical imaging results for changing health behaviour. *Cochrane Database of Systematic Reviews*, CD007434. doi:10.1002/14651858.CD007434.pub2

Jackson, K. M., & Aiken, L. S. (2000). A psychosocial model of sun protection and sunbathing in young women: The impact of health beliefs, attitudes, norms, and self-efficacy for sun protection. *Health Psychology, 19*, 469–478. doi:10.1037/0278-6133.19.5.469

Jackson, K. M., & Aiken, L. S. (2006). Evaluation of a multicomponent appearance-based sun-protective intervention for young women: Uncovering the mechanisms of program efficacy. *Health Psychology, 25*, 34–46. doi:10.1037/0278-6133.25.1.34

Jacobson, N. S., & Baucom, D. H. (1977). Design and assessment of nonspecific control groups in behavior-modification research. *Behavior Therapy, 8*, 709–719. doi:10.1016/S0005-7894(77)80203-7

Jobim, A. C., & de Moraes, V. (Writers). (1962). The girl from Ipanema (Recorded by A. Gilberto, J. Gilberto, & S. Getz), *On Getz/Gilberto*. United States: Verve Records.

Linos, E., Swetter, S. M., Cockburn, M. G., Colditz, G. A., & Clarke, C. A. (2009). Increasing burden of melanoma in the United States. *Journal of Investigative Dermatology, 129*, 1666–1674. doi:10.1038/jid.2008.423

Lohr, J. M., DeMaio, C., & McGlynn, F. D. (2003). Specific and nonspecific treatment factors in the experimental analysis of behavioral treatment efficacy. *Behavior Modification, 27*, 322–368. doi:10.1177/0145445503253831

Mahler, H. I. M., Kulik, J. A., Gerrard, M., & Gibbons, F. X. (2006). Effects of two appearance-based interventions on the sun protection behaviors of Southern California beach patrons. *Basic and Applied Social Psychology, 28*, 263–272. doi:10.1207/s15324834basp2803_5

Mahler, H. I. M., Kulik, J. A., Gerrard, M., & Gibbons, F. X. (2007). Long-term effects of appearance-based interventions on sun protection behaviors. *Health Psychology, 26*, 350–360. doi:10.1037/0278-6133.26.3.350

Mahler, H. I. M., Kulik, J. A., Gerrard, M., & Gibbons, F. X. (2010). Effects of upward and downward social comparison information on the efficacy of an appearance-based sun protection intervention: A randomized, controlled experiment. *Journal of Behavioral Medicine, 33*, 496–507. doi:10.1007/s10865-010-9279-3

Mahler, H. I. M., Kulik, J. A., Harrell, J., Correa, A., Gibbons, F. X., & Gerrard, M. (2005). Effects of UV photographs, photoaging information, and use of sunless tanning lotion on sun protection behaviors. *Archives of Dermatology, 141*, 373–380. doi:10.1001/archderm.141.3.373

Michie, S., & Abraham, C. (2004). Interventions to change health behaviours: Evidence-based or evidence-inspired? *Psychology & Health, 19*, 29–49. doi:10.1080/0887044031000141199

Muthén, L. K., & Muthén, B. O. (1998–2007). *Mplus User's Guide. Fifth Edition.* Los Angeles, CA: Muthén & Muthén.

Myers, L. B., & Horswill, M. S. (2006). Social cognitive predictors of sun protection intention and behavior. *Behavioral Medicine, 32*, 57–63. doi:10.3200/BMED.32.2.57-63

Olson, A. L., Gaffney, C. A., Starr, P., & Dietrich, A. J. (2008). The impact of an appearance-based educational intervention on adolescent intention to use sunscreen. *Health Education Research, 23*, 763–769. doi:10.1093/Her/Cym005

Olson, A. L., Gaffney, C., Starr, P., Gibson, J. J., Cole, B. F., & Dietrich, A. J. (2007). SunSafe in the middle school years: A community-wide intervention to change early-adolescent sun protection. *Pediatrics, 119*, E247–E256. doi:10.1542/peds.2006-1579

Paul, C., Tzelepis, F., Parfitt, N., & Girgis, A. (2008). How to improve andolescents' sun protection behavior? Age and gender issues. *American Journal of Health Behavior, 32*, 387–398. doi:10.5993/AJHB.32.4.6

Reynolds, K. D., Buller, D. B., Yaroch, A. L., Maloy, J. A., & Cutter, G. R. (2006). Mediation of a middle school skin cancer prevention program. *Health Psychology, 25*, 616–625. doi:10.1037/0278-6133.25.5.616

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology, 91*, 93–114. doi:10.1080/00223980.1975.9915803

Romer, D. (2010). Adolescent risk taking, impulsivity, and brain development: implications for prevention. *Developmental Psychobiology, 52*, 263–276. doi:10.1002/dev.20442

Saraiya, M., Glanz, K., Briss, P. A., Nichols, P., White, C., Das, D., et al. (2004). Interventions to prevent skin cancer by reducing exposure to ultraviolet radiation—A systematic review. *American Journal of Preventive Medicine, 27*, 422–466.

Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology—An International Review, 57*, 1–29.

Stanton, W. R., Janda, M., Baade, P. D., & Anderson, P. (2004). Primary prevention of skin cancer: A review of sun protection in Australia and internationally. *Health Promotion International, 19*, 369–378. doi:10.1093/heapro/dah310

Statistisches Bundesamt (Federal Statistical Office). (2010). Bruttoinlandsprodukt, regionale Tiefe: Kreise (Gross Domestic Product in Districts). Retrieved April 12th, 2012 https://http://www.regionalstatistik.de/genesis/online

Strathman, A., Gleicher, F., Boninger, D. S., & Edwards, C. S. (1994). The consideration of future consequences: Weighing immediate and distant outcomes of behavior. *Journal of Personality and Social Psychology, 66*, 742–752. doi:10.1037/0022-3514.66.4.742

Van Osch, L., Reubsaet, A., Lechner, L., Candel, M., Mercken, L., & De Vries, H. (2008). Predicting parental sunscreen use: Disentangling the role of action planning in the intention-behavior relationship. *Psychology & Health, 23*, 829–847. doi:10.1080/08870440701596577

Weinstein, N. D. (2003). Testing four competing theories of health-protective behavior. In P. Salovey & A. J. Rothman (Eds.), *Social psychology of health* (pp. 33–46). New York, NY, USA: Psychology Press.

White, K. M., Hyde, M. K., O'Connor, E. L., Naumann, L., & Hawkes, A. L. (2010). Testing a belief-based intervention encouraging sun-safety among adolescents in a high risk area. *Preventive Medicine, 51*, 325–328. doi:10.1016/j.ypmed.2010.07.003

Whiteman, D., Whiteman, C., & Green, A. (2001). Childhood sun exposure as a risk factor for melanoma: A systematic review of epidemiologic studies. *Cancer Causes and Control, 12*, 69–82. doi:10.1023/A:1008980919928

Wichstrøm, L. (1994). Predictors of Norwegian adolescents' sunbathing and use of sunscreen. *Health Psychology, 13*, 412–420. doi:10.1037/0278-6133.13.5.412