

Women's sun protection cognitions in response to UV photography: the role of age, cognition, and affect

Laura A. Walsh · Michelle L. Stock ·
Laurel M. Peterson · Meg Gerrard

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Abstract This study examined the impact of ultraviolet (UV) photography, cognition versus affect, and age on women's sun-related cognitions and a proxy measure of sun protection behavior. Participants ($N = 114$) were recruited via public advertisements and came to the lab to view a photo showing their UV damage. In addition, some participants received instructions to focus on either their thoughts (cognition) or feelings (affect) about their photograph before completing the survey. Women in the affect condition reported the lowest perceived vulnerability to skin cancer and highest absent/exempt beliefs (beliefs that one is unlikely to develop skin cancer if she hasn't already). Condition by age interactions showed that, among those in the cognition and control (no instructions) conditions, older women reported higher perceived vulnerability and lower absent/exempt beliefs, and took more sunscreen than younger women. However, older women reported higher absent/exempt beliefs and higher sun-risk willingness than younger women in the affect condition.

Keywords Skin cancer · Interventions · UV photography · Dual processing · Risk perception

Introduction

In the United States, up to 50 % of people aged 65 and older will be diagnosed with skin cancer, making it the

country's most common cancer (National Cancer Institute [NCI], 2012). Skin cancer prevention is an important concern for White women, as their melanoma rates increased annually between 1999 and 2008 (Centers for Disease Control [CDC], 2012a). Given that exposure to ultraviolet (UV) light is linked to the three most common forms of skin cancer (basal and squamous cell carcinomas, and melanoma; American Cancer Society [ACS], 2012a, b), behaviors that protect the skin from UV rays (including wearing sunscreen and protective clothing, and avoiding the sun and tanning beds) are recommended (ACS, 2012a, b; CDC, 2012b; Skin Cancer Foundation, 2012a). It is important to encourage these behaviors at all ages. Among young adults (aged 18–29), sun protection behaviors are particularly low (Coups et al., 2008; NCI, 2012). Additionally, melanoma is increasing among women aged 18–39 (Reed et al., 2012). Sun protection is also important for older adults given that approximately half of one's UV exposure is acquired after age 40 (Skin Cancer Foundation, 2012b).

Predicting sun protection behaviors: sun protection cognitions and UV photography

Cognitions included in several models of health behavior have been shown to predict engagement in sun protection and risk behaviors (e.g., sunscreen use and tanning) and are therefore important to encourage in interventions. One model that guided the present study and has been included in several prior studies of sun protection behaviors and cognitions is the Prototype/Willingness (P/W) model (Gibbons et al., 2003, 2005; Walsh & Stock, 2012). The P/W model is based on the premise that engagement in health behaviors can be both planned and unplanned, and thus contains both a reasoned and a social reaction pathway

L. A. Walsh (✉) · M. L. Stock · L. M. Peterson
Department of Psychology, The George Washington University,
Washington, DC 20052, USA
e-mail: lwalsh@gwmail.gwu.edu

M. Gerrard
Department of Psychology, University of Connecticut, Storrs,
CT, USA

predicting behavior. In the reasoned pathway, which is conceptually similar to the Theory of Reasoned Action (Ajzen & Fishbein, 1980), behavioral intention is the immediate predictor of behavior. Intention is predicted by perceptions of vulnerability and perceived norms related to the behavior of interest. The social reaction pathway involves behavioral willingness (an openness, rather than a plan, to engage in the behavior in different social scenarios) as the immediate behavioral predictor (see Gerrard et al., 2008; Gibbons et al., 2003 for full reviews of the model).

Sun protection cognitions, including those in the P/W model, have been positively impacted by UV photography. As a sun protection intervention, UV photography involves showing individuals a photograph of their facial skin damage due to UV exposure (Fulton, 1997). Combined with receiving information on the negative consequences of UV exposure, this intervention has led to: higher perceived vulnerability to skin cancer or photoaging, lower willingness to tan, and higher willingness to protect one's skin. In addition, UV photography has also led to higher sun protection intentions and more favorable attitudes toward protecting one's skin (Gibbons et al., 2005; Mahler et al., 2010; Stock et al., 2009, Walsh & Stock, 2012). These sun protection cognitions have contributed to mediating the effects of UV photography interventions on increases in sun protection behavior (and/or decreases sun risk behavior) among young adult men and women, and older male adult road workers (e.g., Gibbons et al., 2005; Mahler et al., 2010; Stock et al., 2009). A recent review of appearance-focused interventions found that interventions containing UV photography as well as information about the appearance consequences of sun exposure resulted in higher sun protection intentions and perceptions of risk of photoaging across studies (Williams et al., 2013).

In addition to P/W model cognitions, the endorsement of absent/exempt beliefs is another construct that is important to consider in health behavior promotion (including UV protection). Absent-exempt involves believing that if one has not yet experienced a negative outcome (e.g., skin cancer) due to engagement in a risk behavior (e.g., unprotected sun exposure), he or she is unlikely to experience that outcome in the future (Weinstein, 1982, 1987). Absent-exempt beliefs offer a potentially important means of addressing low levels of sun protection behaviors in adult women. Research has shown that experience with health risk behaviors is often negatively associated with perceptions of health risks (e.g., Halpern-Felsher et al., 2001; Katz et al., 2000), especially when there are also outcomes of risk behaviors that are enjoyable (Goldberg et al., 2002). This association between experience and risk perception suggests that women who have accumulated experience with unprotected sun exposure but have not

been diagnosed with skin cancer may report lower risk perceptions and be less inclined to increase their levels of sun protection behaviors in the future. In addition, absent-exempt beliefs are higher among older, versus younger, women, suggesting that the relevance of absent-exempt beliefs may increase with age (Gerend et al., 2004).

The current study expanded upon previous research by examining the scope of UV photography's impact on the sun protection cognitions of adult women of varying ages. We examined the effect of UV photography on two constructs contained within the P/W model (perceived vulnerability and sun risk willingness), as well as absent-exempt beliefs, which have not been included in published studies of sun protection interventions. In addition, past studies of the impact of UV photography on sun protection cognitions were extended by examining how the intervention is affected when it is accompanied by instructions to focus on cognition (logical thoughts) or affect (feelings/heuristic reactions). This manipulation was based on literature on the importance of cognition and affect in perceived risk and the prediction of health behaviors.

The influence of cognition and affect on perceived risk and health behavior

Both cognition (thoughts) and affect (feelings) contribute to the prediction of health behavior. Research in this area is guided by dual-process models (including the P/W model) which posit that decisions and behavior (including health behavior) are influenced by both cognitive and affective processes (e.g., Finucane & Holup, 2006; Gibbons et al., 2003). Both cognition and affect have been found to influence health behaviors, as well as attitudes toward and intentions to engage in these behaviors (Keer et al., 2010; Lawton et al., 2009). Therefore, both types of processing are important to consider in health interventions (Gerrard et al., 2008).

Research in the areas of perceived risk and persuasion illustrates the contributions of both cognition and affect in health promotion. In addition to logical thoughts (cognition) about risk, more affective components (e.g., heuristic processing of information, general feelings of being at risk, and anticipated/experienced worry and regret) also contribute to risk and are important and immediate predictors of health behavior and behavioral intentions (e.g., Chapman & Coups, 2006; Dillard et al., 2012; Finucane & Holup, 2006; Köblitz et al., 2009; Loewenstein et al., 2001; Moser et al., 2007; Weinstein et al., 2007). In some cases, feelings of being at risk may be stronger predictors of health behaviors and intentions than more logical components of perceived risk (Dillard et al., 2012; Janssen et al., 2012; Weinstein et al., 2007).

The importance of cognition and affect has also been demonstrated in studies of health promoting messages. For example, individuals may be more persuaded to exercise by a message that focuses on affective, versus cognitive, consequences of the behavior (Conner et al., 2011), and blood donation intentions and behaviors can be differentially influenced by messages that emphasize either affect or cognition (Farley & Stasson, 2003; Mayer & Tormala, 2010). Although these studies suggest that affect may promote positive thoughts about engagement in health behaviors, the influence of affective versus cognitive messages on behavior might vary depending on several factors, such as the type of behavior (Farley & Stasson, 2003) and individual differences including if a person's underlying attitude toward the health behavior is cognitive or affective in nature (e.g., Huskinson & Haddock, 2004; Mayer & Tormala, 2010).

Information is lacking on whether cognition or affect should be promoted in interventions to increase sun protection cognitions and behaviors. Janssen et al., (2012) found that feelings of being at risk for skin cancer were a better predictor of intentions to get tanned and to enact sun protection behaviors than rational thoughts about one's risk level. In addition, one recently published study examined younger and older adults' visual attention to negative emotional content about skin cancer risk versus informational content on skin examinations. Among participants who were specifically instructed to avoid negative emotions, older adults focused less on the negative content than younger adults. Older adults' engagement in more sun protection strategies at the end of the study suggested that their visual strategy may have been related to corresponding positive behaviors (Isaacowitz & Choi, 2012). However, no study to date has examined the impact of cognition versus affect in the context of receiving skin cancer information about one's *personal* skin damage. Given that it has been suggested that future studies examine whether focusing on affect or cognition is most influential in specific scenarios (Finucane & Holup, 2006), the current study examined the role of cognition versus affect in the context of a personally relevant intervention that has been effective in increasing sun protection cognitions and behaviors: UV photography.

Unanswered questions in UV photography

Despite evidence for the effectiveness of UV photography, additional research questions related to its impact need to be addressed. Specifically, research on skin cancer prevention has largely not been extended to older adult women (Clarke & Korotchenko, 2009). In addition, although some studies have examined whether the strength of the intervention can be enhanced or weakened by other experimental

manipulations (Mahler et al., 2008, 2010), no study has examined the impact of encouraging participants to focus on cognition or affect (feelings/heuristic reactions) in response to their UV photograph. Dual-process models suggest that cognitive and affective pathways are both malleable and important in behavioral prediction (Gerrard et al., 2008); therefore, the present study examined whether a focus on cognition versus affect moderates intervention effects on sun protection cognitions.

The impact of age on UV photography, cognition, and affect

We also aimed to determine whether age moderates the effects of an experimentally manipulated focus on affect or cognition on women's sun protection cognitions in the context of UV photography. Given that sun exposure is acquired at all ages, it is important to extend work on sun protection interventions to adults who are older than college-age. Although an intervention containing UV photography has been studied among older adult men (Stock et al., 2009), it has not been examined specifically among older adult women. Given that dual-process models suggest that age is associated with changes in processing styles (Gerrard et al., 2008; Reyna, 2008), it is important to determine whether age moderates the impact of affective or cognitive reactions to health risk information. Some studies have found that older adults rely more on affective information and intuitive processing to determine their level of risk and to make decisions related to health (e.g., Finucane, 2008; Mikels et al., 2010; Peters et al., 2008). In addition, a recent study found that age moderated responses to emotional versus informational content in skin cancer education videos such that older adults focused less on the negative emotional features of the videos compared to younger adults (Isaacowitz & Choi, 2012). However, research has not examined age as a moderator of instructions to focus on cognition or affect in response to personal health risk information, such as the information received by viewing one's UV photograph.

The current study

The current study was designed to: (1) determine whether focusing on affective versus cognitive responses moderates the impact of UV photography interventions on adult women's sun protection cognitions, and (2) examine whether age moderates these effects. To answer these questions, younger and older women were randomly assigned to either a standard UV photography condition or one that was accompanied by instructions to focus on either cognition (thoughts) or affect (feelings). We examined the

impact of these conditions on: perceived vulnerability to developing skin cancer, absent-exempt beliefs, sun risk willingness, and the number of sunscreen packets that participants took when offered samples at the end of the study.

Method

Participants

One-hundred and fourteen White females ages 27–67 ($M = 46.20$) were recruited via public advertisements in the Washington, D.C. metro area. Advertisements about the study were posted on Craigslist, distributed in the public by research assistants, and posted in buildings. All participants completed this study for monetary compensation (\$15 or \$20, depending on date of enrollment in the study).

Procedure

After providing informed consent, each participant had a UV photograph taken of her face with a Polaroid camera which reveals underlying UV damage (Fulton, 1997). This camera simultaneously takes a photograph showing UV damage and a regular photograph. The resulting print is of the two photographs side-by-side. The experimenter showed each participant her photographs and indicated that differences between the two photos show evidence of existing skin damage due to UV exposure (e.g., Gibbons et al., 2005; Stock et al., 2009).

Participants were randomly assigned to one of three instructional conditions: cognition, affect, or control. At the beginning of the study, those in the cognition condition ($n = 38$) were told that the purpose of the study was to assess logical thoughts about the UV photograph, while those in the affect condition ($n = 37$) were told that the purpose of the study was to assess feelings about the UV photograph. Participants in the control condition ($n = 39$) did not receive instructions specific to either cognition or affect. After the photographs were taken, each participant was left alone briefly with her photos before the experimenter returned to the lab. At this point, the experimenter provided the survey to the participant and reminded those in the cognition (and affect) conditions that the purpose of the study was to assess their logical thinking process (or their emotional reactions). Prior to reporting on their sun protection cognitions, participants in the cognition and affect conditions were also asked to record their thoughts (or feelings) about their UV photograph.

The survey questions were preceded by typed instructions similar to those that were verbally stated to the participants at the start of the study: those in the cognition

condition were instructed to “think logically” about their answers, while those in the affect condition were instructed to answer with their “initial, gut-level emotional reactions.” Participants in the control condition did not read specific guidelines before answering the questions. The survey assessed sun protection cognitions, as well as several control variables. As a final measure of the impact of the experimental conditions, the experimenter offered participants free sunscreen samples and then recorded the number of samples taken after the participant left. The university’s institutional review board approved the study’s procedures.

Measures

Thoughts/feelings list

Participants in the cognition and affect conditions wrote their thoughts or feelings about seeing their UV photo. Six lines were provided on which participants could record their thoughts or feelings. Two coders rated each response as focusing on either thoughts or feelings. Interrater reliability (intra-class correlation) was .90. Similar thought listing procedures are used to interpret what individuals in groups are thinking or feeling at a given moment (Cacioppo et al., 1997). These procedures have also been utilized to assess individuals’ level and type of processing after receiving health-related messages (e.g., Bassett-Gunter et al., 2012; Holt et al., 2008).

Sun risk willingness

Participants were presented with two hypothetical scenarios similar to those used in previous research (Gibbons et al., 2005; Mahler et al., 2010) and asked how willing they would be to engage in sun risk behaviors within the context of these scenarios. In one willingness scenario, participants were asked to “Suppose you are spending the weekend traveling with a friend or family member. It is a very warm and sunny day and you decide to spend much of the day doing outdoor activities (e.g., sight seeing, walking). However, you do not have any sunscreen.” This scenario was followed by three questions which read, “In this situation, how willing would you be to... (1) Go ahead without any sunscreen, (2) Go without sunscreen, but for a few hours, and (3) Decide on indoor activities (re-coded).” Participants were also asked in the context of another scenario how willing they would be to be to go boating for the day with a friend without any sunscreen. All four willingness items were rated on a 7-point scale (1 = *not at all willing*; 7 = *very willing*) and were averaged into a single index ($\alpha = .79$). These scenarios are relevant to skin

cancer risk in that they refer to recreational and leisure time activities. Recreation and leisure are common reasons for spending time outdoors (Kwok et al., 2009) and lead to a type of sun exposure that is linked to skin cancer (Gandini et al., 2005; Krickler et al., 2007).

Perceived vulnerability

Perceived vulnerability to skin cancer was assessed with a single item: “What do you think the chances are that you will be diagnosed with skin cancer at some point in your future?” (1 = *no chance*; 7 = *very likely*; Stock et al. 2009).

Absent-exempt beliefs

Three questions assessed absent-exempt beliefs related to skin cancer. Participants rated their level of agreement with the statements informed by prior research (Gerend et al., 2004; Weinstein, 1987): “If I have not gotten skin cancer by now... (1) I am probably not going to get it, and (2) I am probably not going to get it whether or not I protect myself from the sun,” as well as, “If other women my age have not gotten skin cancer by now, they are probably not going to get it in the future” (1 = *strongly disagree*; 7 = *strongly agree*). These items were averaged into a single index ($\alpha = .84$).

Sunscreen packets

Six sample packets of sunscreen were in a bowl by the door exiting the lab. Participants were told that they could take as many as they wanted. The experimenter recorded the number of sunscreen packets taken by each participant after she left. Assessing whether participants take or use sunscreen samples as an indicator of sun protection has also been included in other sun protection studies (e.g. Isaacowitz & Choi, 2012; Mahler et al., 2005).

Control variables

Participants provided information on four potential confounding variables: skin cancer history, sunscreen use, protective clothing use, and tanning behaviors. These variables were included as controls in the final analyses. *Skin cancer history* was assessed by asking participants whether or not they had a previous history of skin cancer or pre-cancerous spots. *Sunscreen use* (“How often do you use sunscreen on your body and face when you spend time outdoors?”), *Protective clothing use* (“When you spend time in the sun, how often do you wear protective clothing [e.g., long sleeves, hat, pants] to protect yourself from the

sun?”), and *Tanning* (“During the typical summer, how often do you spend time in the sun with the purpose of getting some color?”) were each assessed on a 7-point scale (1 = *never*; 7 = *always*).

Statistical analyses

Preliminary analyses included descriptive statistics and correlations to describe the data of the present sample and relationships among all study variables. A series of analyses of variance (ANOVAs) were also run to: (1) check the effectiveness of the experimental manipulation by comparing the thoughts versus feelings listings across conditions, and (2) check for randomization problems. Hierarchical multiple regression analyses were used to examine the impact of the experimental conditions, age, and their interaction on sun protection cognitions and our behavioral indicator (number of sunscreen packets taken). All control variables were entered in the first step of the regression, followed by main effects in the second step, and the condition by age interaction in the third (final) step. Age was centered for all interactions and two orthogonal contrasts were created for the condition variables (West et al., 1996). Contrasts were utilized to enter both conditions and the interactions in these analyses, which allowed for an examination of all conditions in a single regression. Because it was hypothesized that the affect condition would differ from both the cognition and control conditions, the first contrast compared the affect condition with the other two conditions (Contrast Affect—Cognition/Control; $-2, 1, 1$). The second contrast compared the cognition condition with the control condition (Contrast Cognition—Control; $0, 1, -1$). In the case of significant interaction effects, simple slope analyses were run to examine the effects of age separately by condition.

Results

Descriptive statistics, correlations, and ANOVAs

Table 1 presents the means, standard deviations, and correlations for all variables. Twelve women reported being diagnosed with skin cancer at some point in their life. Although only 15 % reported at least occasionally spending time outside to purposely get a tan, only 16 % reported always using sunscreen. Eighty-eight percent of women took at least one packet of sunscreen. Willingness to engage in risky sun behaviors was correlated with greater absent-exempt beliefs, more time tanning, lower sun protection behaviors, and a younger age ($ps < .05$). Absent-exempt beliefs were also associated with lower perceived vulnera-

Table 1 Correlations, means, standard deviations, and ranges for sun protection cognitions, age, and control variables

	1	2	3	4	5	6	7	8	9
1. Sun risk willingness	–								
2. Absent-exempt	.19*	–							
3. Perceived vulnerability	–.13	–.43***	–						
4. Sunscreen packets taken	–.03	–.08	.09	–					
5. Age	–.21*	–.04	.21*	.20 [†]	–				
6. Skin cancer history	.06	–.21*	.46***	–.10	.28**	–			
7. Sunscreen use	–.38***	–.20*	.06	.06	.05	–.01	–		
8. Protective clothing use	–.26**	.04	.11	–.07	.17 [†]	.14	.31**	–	
9. Tanning behavior	.32**	.11	.09	.10	–.19*	–.11	.23*	–.17 [†]	–
<i>M</i>	3.87	1.45	4.25	2.40	46.20	.10	4.73	3.45	2.62
<i>SD</i>	1.82	.72	1.64	1.54	11.17	.30	1.79	1.80	1.85
Range	1–7	1–7	1–7	0–6	27–67	0–1	1–7	1–7	1–7

[†] $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

bility, less sunscreen use, and not having a diagnosis of skin cancer ($ps < .05$). Older age was associated with higher perceived vulnerability and a greater likelihood of skin cancer ($ps < .05$; see Table 1 for additional information).

For the ANOVAs on the thoughts and feelings listings that functioned as manipulation checks, the number of thoughtful and feelings-based responses for each participant were each summed and scored from 0 to 6. Women in the affect condition reported more feeling/affective reactions compared to those in the cognition condition ($F(1, 74) = 24.05$, $p < .001$, $Ms = 1.01$ vs. 2.78). In a second ANOVA, women in the cognition condition reported more thoughts than those in the feelings condition ($F(1, 74) = 16.81$, $p < .001$, $Ms = 3.35$ vs. 1.35). The most common feelings-based responses expressed predominantly negative reactions and were associated with surprise, fear, worry, and disgust. For the thoughts listings, the most common reactions began with terms, such as: Can I...?, Will I...?, I wonder...?. ANOVAs performed on the control variables and age showed that, while there was a significant difference in prior protective clothing use between those in the cognition and affect conditions ($F(1, 74) = 4.55$, $p < .02$, $Ms = 4.11$ vs. 2.92), there were no significant differences across condition in any of the other control variables or age ($ps > .15$).

Age, condition, and sun protection cognitions

Hierarchical linear regressions were run to examine the impact of condition, age, and their interaction, on sun protection cognitions and our behavioral indicator.

Sun risk willingness

Participants who reported greater sunscreen and protective clothing use reported lower willingness and those who

reported spending more time tanning reported higher willingness ($\beta s = -.29, -.19, .28$, respectively; $ps < .04$). Willingness did not differ across the experimental conditions ($ps > .5$). The interaction between the Cognition—Control contrast and Age was not significant ($p = .19$), but there was a significant interaction between the Affect—Cognition/Control contrast and age ($\beta = .21$, $t = 2.54$, $p < .02$; see Fig. 1). Simple slopes revealed that among women in the affect condition, a higher age (mean age levels $+1/-1$ SD) was associated with greater willingness to engage in sun risk behavior ($\beta = .26$, $t = 2.46$, $p < .02$). Among participants in the cognition/control conditions, however, the relationship between age and willingness was non-significant ($p = .26$).

Perceived vulnerability

Having a history of skin cancer, greater time spent tanning, and older age were associated with higher levels of perceived vulnerability ($\beta s = .39, .20, .23$; $ps < .03$). The

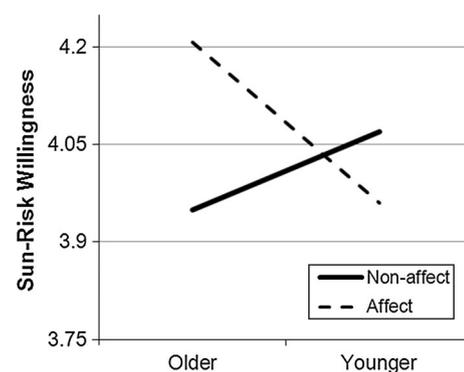


Fig. 1 Sun risk willingness as a function of condition contrast Affect—Cognition/Control (affect vs. non-affect) and age

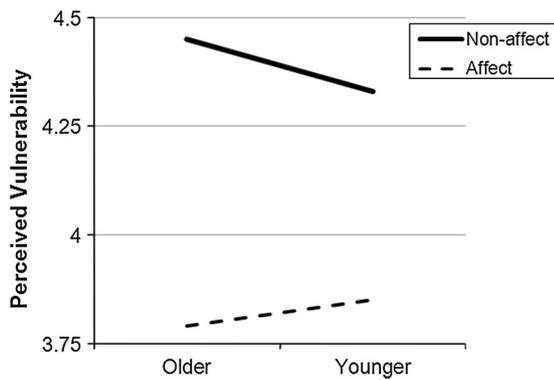


Fig. 2 Perceived vulnerability to skin cancer as a function of condition contrast Affect—Cognition/Control (affect vs. non-affect) and age

Cognition—Control contrast main effect was not significant ($p = .26$), indicating that perceived vulnerability did not differ between these two conditions. However, a significant main effect for the Affect—Cognition/Control contrast showed that participants in the affect condition were less likely to report perceived vulnerability to skin cancer ($\beta = .18, t = 2.04, p < .05$). The Affect—Cognition/Control \times Age interaction was also significant ($\beta = .19, t = 2.32, p < .03$; see Fig. 2). Among participants in the affect condition, age was not significant ($p > .8$). Among women in the cognition/control conditions, however, older age predicted greater perceived vulnerability ($\beta = .34, t = 2.79, p < .01$).

Absent-exempt beliefs

Women who had skin cancer ($n = 12$) were excluded from analyses of absent-exempt beliefs as they are no longer “exempt” from skin cancer. Greater sunscreen use was associated with lower levels of absent-exempt beliefs and greater protective clothing use was associated with higher levels of absent-exempt beliefs ($\beta_s = -.25, .25$ respectively; $ps < .03$). None of the other control variables were significantly associated with absent-exempt beliefs. The Cognition—Control contrast was not significant ($p > .8$), indicating that, as with willingness and perceived vulnerability, there was no main effect of cognition versus control condition. However, similar to perceived vulnerability, a significant main effect was once again found for the Affect—Cognition/Control contrast: participants in the affect condition were more likely to report absent-exempt beliefs compared to those in the cognition/control conditions ($\beta = -.27, t = -2.83, p < .01$). A significant Affect—Cognition/Control \times Age interaction ($\beta = -.31, t = -3.23, p < .01$; see Fig. 3) revealed that among participants in the affect condition, age was associated with higher levels of absent-exempt beliefs ($\beta = .35, t = 2.07,$

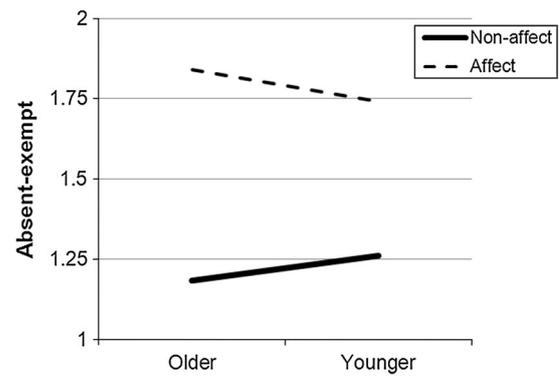


Fig. 3 Absent-exempt beliefs as a function of condition contrast Affect—Cognition/Control (affect vs. non-affect) and age

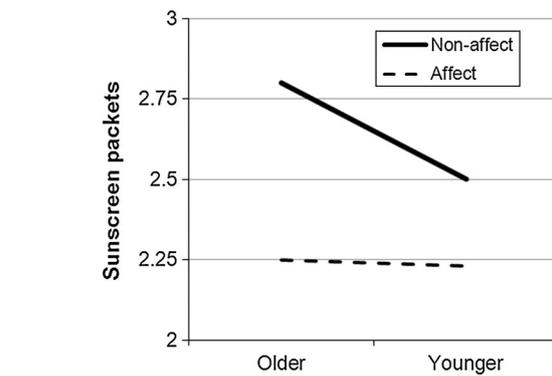


Fig. 4 Sunscreen packets taken as a function of condition contrast Affect—Cognition/Control (affect vs. non-affect) and age

$p < .05$). Among women in the cognition/control conditions, however, older age predicted lower reported absent-exempt thinking ($\beta = -.28, t = -2.28, p < .03$).

Sunscreen packets

Older women took significantly more sunscreen packets ($\beta = .38, t = 3.41, p < .001$). Number of packets taken did not differ by condition (contrast main effect $ps > .1$). However, a marginal Affect—Cognition/Control \times Age interaction was found ($\beta = .20, t = 1.95, p < .06$; see Fig. 4), such that among participants in the affect condition, age was not associated with packets taken ($p = .44$). However, among women in the cognition/control condition, older age predicted a greater number of packets ($\beta = .47, t = 3.69, p < .001$).¹

¹ The pattern of findings for perceived vulnerability, sun-risk willingness, and number of sunscreen packets taken remained the same when excluding participants who reported a previous diagnosis of skin cancer.

Discussion

The results of the present study demonstrate that, when learning about one's UV damage via a UV photography intervention, a focus on affective reactions detracted from the effectiveness of the intervention among adult women, by leading to lower perceptions of vulnerability and higher levels of absent-exempt beliefs compared to women who did not focus on affect. In addition, focusing on one's affective/emotional reactions had a particularly negative impact among the older women, who reported higher sun risk willingness and absent-exempt beliefs compared to younger women. However, in the non-affect (cognition/control) conditions, older women reported *lower* levels of absent-exempt beliefs, higher perceived vulnerability, and took more sunscreen packets. The levels of sun protection cognitions reported after viewing one's UV photograph did not differ among women who were instructed to focus on their cognitions (logical thoughts) and those who received no instructions.

Affect, cognition, and UV photography

These findings contribute to literature on the role of affect and cognition in risk perception and health messaging. Specifically, this study identified a scenario in which a focus on affect (e.g., immediate emotional reactions) was not beneficial, particularly when these feelings are predominantly negative (as was the case in the present study). While prior research demonstrates that affect is an important predictor of health promoting thoughts and behaviors (Chapman & Coups, 2006; Köblitz et al., 2009; Moser et al., 2007; Weinstein et al., 2007), this study suggests that women's emotionally-focused responses to learning about their skin damage do not result in immediate enhancement of sun protection cognitions. Encouraging affective reactions to one's UV-related skin damage may not be an effective short-term sun protection intervention strategy, while encouraging cognition (logical thoughts) may be beneficial.

Age as a moderator

In addition, the present findings suggest that focusing on one's cognitive reactions about skin damage and sun protection (rather than affective reactions) may be particularly beneficial for older women, since they reported less protective cognitions than younger women in the affect-focused condition. Given that skin cancer is more common with age (Skin Cancer Foundation, 2012b), it is possible that these results occurred because skin cancer might be a more salient or relevant concern for older women. Relevance is

an important predictor of how information is processed. Increased personal relevance may lead to a greater tendency to engage in logical processing (Peters et al., 2006), but in the domain of health, a health message that is personally relevant and makes one feel vulnerable can also increase biases in processing (de Hoog et al., 2005; Liberman & Chaiken, 1992). In the present study, being instructed to focus on their thoughts might have increased overall logical processing for high relevance participants (e.g., older women), and/or reduced thoughtful defensive processing seen in high-relevance participants in earlier research (Liberman & Chaiken, 1992).

Related to the uniqueness of the UV photography intervention technique, another reason why the affect condition may have been less effective in promoting protective cognitions for older women is through inducing immediate negative reactions to their UV photograph. Given that skin damage accumulates over time, older women likely saw photographs that showed more damage than those seen by younger women. It is possible that older women in the affect condition responded to their UV photograph with immediate reactions that they have a relatively high level of personal skin damage but can do little about it. This possible immediate reaction could be due both to older women in the present study potentially having a higher level of cumulative damage due to sun exposure shown in their photographs, as well as research suggesting that the sun protection habits of younger individuals (e.g., younger than age 40) contribute more substantially to later melanoma risk (Solomon et al., 2004). In addition, older adults might experience gut-level reactions that there is no point in starting to protect their skin now if they had not done so in the past (Ngune et al., 2009). Thus, it may be important to avoid enhancing affective reactions to personal skin cancer risk in interventions for older women.

Cognitive reactions to UV photographs

The failure to find significant differences between the cognition-focused condition and the no-instruction condition suggests that cognitive reactions may be women's default response when confronted with evidence of their vulnerability to consequences of UV exposure. One explanation for this is that even in the absence of specific processing instructions, UV photographs may induce logical thoughts about skin cancer risk because the photos present a new type of risk information that the women have not previously considered. However, the actual proportion of thoughts versus feelings experienced by women in the control condition in the present study is unknown. In order to clarify whether a focus on cognition can help explain

beneficial UV photography effects, future studies should investigate unprompted reactions participants have when viewing their UV photographs.

Limitations and future directions

The present study contributes to theoretical questions about distinctions between cognitive and emotional risk perception, as well as applied research on UV photography as an intervention to enhance sun protection cognitions. However, this study leaves several remaining questions for future studies. First, to clarify why age moderated condition effects, future research should assess additional variables, including perceived salience of the health threat or control beliefs. This will allow for determining whether perceiving high levels of threat or low perceived control over changing one's skin cancer risk explains why emotional reactions to UV photography had a negative impact for older women. Additional factors that should be assessed in future studies include demographic variables such as education and socioeconomic status, given that sun protection is often positively correlated with income and educational attainment (e.g., Bränström et al., 2004; Santmyre et al., 2001). In addition, researchers should study the role of affect versus cognition in the context of other variables that moderate the impact of sun protection interventions, such as social comparison (Hoffner & Ye, 2009; Mahler et al., 2010).

In addition, while the present study illustrated the impact of the intervention on behavioral cognitions as well as a proxy behavioral measure (i.e., the number of sunscreen packets women took at the end of the study), actual sun protective behavior (e.g., greater application of sunscreen) was not assessed. Future research should examine whether the positive impact of focusing on thoughts/cognitions extends to subsequent protective behavior and additional behavioral willingness scenarios.

Future studies would also benefit from examining whether the impact of an affective versus cognitive focus varies depending on the specific outcomes of interest. The present results suggest that different factors may be driving the pattern of effects for sun risk willingness, versus taking sunscreen packets in a lab setting. In the case of willingness, it appears that it is older women in the *affect-focused* condition who have particularly high sun risk willingness compared to each of the other groups (see Fig. 1). However, it seems that the effects on taking sunscreen packets are less driven by the affect condition than by the *non-affect (cognition-focused) conditions*, in which older women took more sunscreen packets than both of the other groups (see Fig. 4). It is plausible that, for older women, focusing on one's thoughts has a strong effect on taking sunscreen packets in a controlled lab setting, where

protection behavior is more deliberate. However, willingness to engage in sun risk behaviors may be more strongly impacted by an intervention approach based in affect, since the willingness items ask participants to imagine themselves in scenarios which are socially-based and less influenced by deliberate thought (Gerrard et al., 2006; Gibbons et al., 2009). Future studies would benefit from a more in-depth assessment of the current procedures on additional cognitions within the P/W model.

In addition, further research should focus on clarifying the role of age in the effects of interventions designed to increase sun protection cognitions and behaviors, as well as whether other UV interventions should be adapted for older adults. Although sun protection behaviors generally increase with age, there is also some evidence that sunscreen use in particular stops increasing at older ages (Nigg et al., 1999; Santmyre et al., 2001). Therefore, another important point to consider in sun protection interventions for older adults is whether specific sun protection strategies should receive greater promotion or attention compared to others.

Conclusion

The current study provides evidence that a focus on one's cognition versus affect can have an important influence on the impact of a UV photography intervention on adult women's sun protection cognitions. In addition, this study demonstrates that age moderated these effects on women's sun risk willingness, perceived skin cancer vulnerability, absent-exempt beliefs, and a preliminary measure of sun protection behavior. These findings have implications for future sun protection interventions among adult women, particularly those who are older in age. Additional studies should further clarify why thoughtful reactions toward one's sun damage contribute to protective cognitions among older women and whether these effects extend to other intervention approaches and follow-up measures of behavior.

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