J Behav Med
https://doi.org/10.1007/s10865-019-00104-6

Combining a UV photo intervention with self-affirmation or self-compassion exercises: implications for skin protection

Charlotte J. Hagerman[1] · Michelle L. Stock[1] · Brianne K. Molloy[1] · Janine B. Beekman[1] · William M. P. Klein[2] · Nicole Butler[1]

Received: 10 May 2019 / Accepted: 24 September 2019

Abstract The current study tested whether self-affirmation or self-compassion exercises, shown to increase message acceptance, could maximize the benefit of a UV photo intervention on skin protection cognitions. College women (N = 167) were randomly assigned to: (1) view a UV photo or Black and White (no-UV) photo of their face and (2) write a self-affirmation, self-compassion, or neutral essay. Participants who saw their UV photo reported healthier cognitions, including greater perceived vulnerability and intentions to protect skin. Within the self-compassion condition, participants who saw their UV photo were also more likely to take the sunscreen packets offered. However, neither self-affirmation nor self-compassion enhanced the effect of the UV photo. Within the UV condition, women who completed these exercises had similar (and occasionally *less* healthy) cognitions and behavior as those who wrote a neutral essay. The benefits of self-affirmation and self-compassion in conjunction with health messages may be limited to higher risk groups who experience more message defensiveness than the current sample.

Keywords Self-affirmation · Self-compassion · UV photography · UV intervention · Skin protection

Introduction

Skin cancer is by far the most prevalent form of cancer, and rates of both melanoma and non-melanoma (i.e., basal and squamous cell carcinoma) diagnoses are increasing (Mohan & Chang, 2014; Skin Cancer Foundation, 2019). Fortunately, skin cancer is highly preventable, and individuals can reduce their risk through skin protection behaviors such as using sunscreen, wearing protective clothing, or seeking shade (Prevent Cancer Foundation, 2019). Young adults report the lowest rates of skin protection behaviors and the most sunburns (Centers for Disease Control and Prevention, 2018; Kasparian et al., 2009; Buller et al., 2011), suggesting that young adulthood is a critical time to implement interventions that encourage healthier skin protection.

Because skin protection cognitions and behavior differ by gender, interventions in this domain should be developed and tested separately for men and women (Centers for Disease Control and Prevention, 2018; Kasparian et al., 2009; Haluza et al., 2015). Women engage in more intentional tanning and report a stronger desire to have tanned skin (Holman & Watson, 2013). Further, women's rates of skin cancer are increasing faster than men's, almost doubling in the last 30 years (Mohan & Chang, 2014). However, women use sunscreen more often than men (Kasparian et al., 2009) and report more appearance-based motivations for protecting their skin (Cafri et al., 2008; Maddock et al., 2005). The current study tested strategies to augment the effectiveness of an ultraviolet (UV) photography intervention, an appearance-based intervention for skin protection that is highly relevant and effective for young women (Mahler, 2014).

✉ Michelle L. Stock
mstock@gwu.edu

[1] George Washington University, 2125 G St. NW, Room 306, Washington, DC 20052, USA

[2] Behavioral Research Program, National Cancer Institute, Bethesda, MD, USA

Published online: 30 September 2019

UV photo interventions

In UV photo interventions, individuals receive a UV photo of their skin, which shows their existing skin damage not yet visible to the naked eye (Gibbons et al., 2005; Stock et al., 2009). Studies show that UV photo interventions increase negative mood (Mahler, 2014) but also improve attitudes toward sun protection and increase perceptions of vulnerability for skin cancer (Gibbons et al., 2005; Stock et al., 2009, Walsh & Stock, 2012; Williams et al., 2013). Walsh et al. (2014) also found that viewing a UV photo can lead to lower endorsement of "absent/exempt" thinking, in which individuals underestimate their health risk because they have previously engaged in the risky behavior without experiencing negative outcomes. Most importantly, a meta-analysis showed that UV photo interventions have a small but positive effect on skin protection intentions and behavior (Persson et al., 2018). This intervention has demonstrated effectiveness in a wide variety of populations, including college students, beachgoers, and outdoor workers (Mahler et al., 2006; Stock et al., 2009; Walsh & Stock, 2012).

Despite the many studies showing that UV photos lead to healthier sun protection cognitions and behaviors, some research has demonstrated null and even detrimental effects of this intervention in certain groups. For instance, Walsh & Stock (2012) found that a UV photo increased sun protection cognitions among men with higher self-reported masculinity, but not among those lower in masculinity, who already had comparatively healthy skin protection cognitions. Schüz et al. (2013) found that, among participants (ages 11–71) who reported greater tanning importance (i.e., were higher risk), those who received a UV photo reported *higher* sun exposure 2 weeks later than the similarly high-risk participants who did not receive this intervention (Schüz et al., 2013). Mahler et al. (2007) also found evidence of backfire in response to a UV photo intervention paired with photoaging information; participants who saw their UV photo reported *more* incidental sun exposure at 1-year follow-up.

One potential reason for these detrimental effects of the UV photo is that showing people their skin damage can induce feelings of threat (Schüz et al., 2013). When health messages imply that the recipient's lifestyle has been risky and unhealthy (van Koningsbruggen et al., 2009), they can threaten feelings of self-integrity (Sherman & Cohen, 2002). As such, health information can inspire defensive reactions, or various ways of derogating the message, in order to preserve self-integrity (van't Riet & Ruiter, 2013). For instance, individuals exposed to threatening health information have been shown to lower their estimates of personal risk (Brown & Locker, 2009; Brown & Smith, 2007) and reduce their intentions to change behavior (Dijkstra, 2014). *Personalized* risk feedback is especially vulnerable to defensive reactions. Although increasing the personal relevance of a message can make it more persuasive (Hawkins et al., 2008), such personalization can also increase the perceived threat of the message (Dijkstra, 2014; Schüz et al., 2013). For example, among smokers who were given tailored feedback from a breathing test, those who received a higher "lung age" claimed to have exerted less effort on the breathing test, presumably as a way to justify their unfavorable result (Lipkus & Prokhorov, 2007).

Because UV photo interventions tend to show net-positive effects, it is difficult to discern the extent to which defensive processing inhibits their potential. However, it is possible that the modest effect sizes of this intervention demonstrated in previous literature (Persson et al., 2018) are a product defensive processing. Indeed, studies show that sun protection interventions are *most* effective when paired with defensiveness-reduction strategies (Schüz et al., 2013). Therefore, pairing a UV photo intervention with additional interventions may maximize its effectiveness. For example, researchers found that a UV photo intervention (paired with photoaging information) is more effective for improving skin protection cognitions when participants also receive information about the social norms of skin protection (Mahler et al., 2008).

Self-affirmation

Another strategy that has been paired with UV photo interventions is a self-affirmation writing exercise (Schüz et al., 2013). Self-affirmation increases acceptance of health messages by bolstering self-integrity and feelings of moral adequacy that the message threatens (Cohen & Sherman, 2014). A common manipulation of self-affirmation is to ask participants to choose an important value, such as kindness or honesty, and write about how they behave in accordance with this value in everyday life (Cohen & Sherman, 2014; McQueen & Klein, 2006). These writing opportunities help participants establish that they are morally adequate, making them more willing to accept a message that they have engaged in unhealthy behaviors and to adopt the action that the message recommends (Klein et al., 2011). Three meta-analyses found that participants who self-affirm before receiving a threatening health message have greater intentions to engage in the appropriate behavior than those who do not (Epton et al., 2015; Ferrer & Cohen, 2018; Sweeney & Moyer, 2015).

Self-affirmation and sun protection messages

The aforementioned study by Schüz et al. (2013) explored the potential for self-affirmation to bolster the effect of a UV photo. Among participants who reported greater tanning importance, those who self-affirmed prior to seeing their UV photo reported less sun exposure at a 2-week follow

up than those who did not self-affirm. The beneficial effect of self-affirmation has been found for other types of sun protection messages as well. Jessop et al. (2009) showed that White women who completed self-affirmation exercises engaged in less defensive processing of a message about the health risks of sunbathing than those in a control group. That is, the participants who self-affirmed had more positive attitudes toward using sunscreen and greater intentions to use sunscreen in the future (Jessop et al., 2009). Similarly, among female college students who read efficacy statements (i.e., statements used to increase both self-efficacy and response efficacy for skin protection behavior), those who self-affirmed had greater acceptance of a message about photoaging than those who did not self-affirm (Good & Abraham, 2011).

However, some literature suggests that self-affirmation can backfire in the context of sun protection messages. In fact, Good and Abraham (2011) found an opposite effect of self-affirmation for skin cancer messages. That is, among participants who read self-efficacy statements, those who self-affirmed had *lower* acceptance of the skin cancer message (unlike the photoaging message). Similarly, Mays and Zhao (2016) found that women who completed a self-affirmation exercise before receiving a message about indoor tanning subsequently reported *greater* intentions to indoor tan than those who did not self-affirm.

Although meta-analyses have established that self-affirmation is generally effective in enhancing message acceptance (Epton et al., 2015; Sweeney & Moyer, 2015), overall effect sizes are relatively small and backfire effects are not unheard of within this literature. Self-affirmation can lead to lower message acceptance under specific circumstances—for instance, if the message is not threatening enough to participants (Zhao et al., 2014). It appears that the benefit of self-affirmation in conjunction with health messages is contingent on certain conditions, although the characteristics of these conditions are not yet fully understood (Zhao et al., 2014; Nan & Zhao, 2012). Thus, more research is necessary to understand whether self-affirmation is generally beneficial to pair with sun protection interventions.

Self-compassion

Because self-affirmation has shown mixed effectiveness when paired with a sun protection message, it is important to explore whether other brief interventions might be more effective in enhancing a UV intervention. One promising exercise that has not yet been paired with the UV photo intervention is writing about self-compassion. Self-compassion is treating oneself with kindness and care during negative life experiences (Terry & Leary, 2011). Self-compassion involves three different dimensions: self-kindness: comforting oneself during difficult life circumstances; common humanity: understanding that everyone has struggles and that they are a normal part of life; and mindfulness: balancing one's thoughts and emotions so that they are neither ruminated on nor entirely dismissed (Neff, 2003). Meta-analyses show that trait self-compassion is associated with health-promoting behaviors, such as healthy eating and good sleep (Sirois et al., 2014).

Like self-affirmation, self-compassion can be temporarily bolstered by experimental manipulations (Leary et al., 2007). Researchers typically manipulate self-compassion by asking participants to think about a recent negative experience and express kindness and understanding toward themselves, the way they would to a friend (Breines & Chen, 2012; Leary et al., 2007). Importantly, self-compassion exercises have been shown to mitigate defensive responses to negative information, such as receiving negative feedback on a performance (Leary et al., 2007). These exercises allow participants to acknowledge their role in negative events without feeling overwhelmed by negative emotions. Individuals who complete a self-compassion manipulation are willing to accept their mistakes because they understand that it is acceptable—and human—to make mistakes (Leary et al., 2007).

Whereas self-affirmation is sensitive to context, backfiring under certain conditions (Zhao et al., 2014; Good & Abraham, 2011; Briñol et al., 2007), self-compassion has not demonstrated such conditional effectiveness. That being said, the research on the effects of self-compassion manipulations is far scanter than that on self-affirmation manipulations. Further, despite its beneficial effect on health behaviors and on responses to general negative information, self-compassion has never been studied in the context of threatening health information or sun protection messages specifically. Additionally, its effects have never been directly compared with those of self-affirmation.

Current study

Self-affirmation and self-compassion both offer promising methods for maximizing the potential of a UV photo intervention by increasing individuals' receptiveness to this negative, personalized information. In the current study, participants first reported their past skin protection behavior. Approximately 1 week later, they completed a self-compassion, self-affirmation, or control writing task. They then received a black and white photo of their face, with or without a UV photo of their facial skin damage for comparison. Following the manipulations, participants reported their current mood and several skin protection cognitions, including perceived skin damage, absent-exempt thinking, perceived vulnerability to skin cancer and damage, and intentions to increase skin protection. Finally, participants were offered sunscreen packets on the way out of the experiment.

We hypothesized that participants who received a UV photo would report more favorable sun protection cognitions and take more sunscreen packets than those who did not receive their photo. We also expected that those who received a UV photo and also wrote about self-compassion or self-affirmation would report more favorable cognitions and behavior than those who wrote a neutral essay. However, given the mixed effectiveness of self-affirmation in previous literature and the lack of research on self-compassion in this context, we did not have a priori hypotheses about the relative effectiveness of the two strategies.

Method

Participants

Undergraduate females from an urban, mid-Atlantic university were recruited through the Psychology department subject pool website and received class credit for their participation. A total of 184 women completed the Time 1 survey, but sixteen did not sign up for Time 2 (for various reasons) and one was excluded due to procedural problems. Therefore, 167 women completed the full study. The sample was 56.4% White, 19.4% Asian, 9.1% Latina, 4.8% Black, and 6.1% multiracial, with a mean age of 19.35 (SD = 1.61).

Procedure

This study was approved by the Institutional Review Board. After providing informed consent, participants responded to several demographic questions and baseline behavior measures in an online survey via Survey Monkey (T1). At least 1 week later (T2), participants came into the lab, consented to part two of the study, and were randomly assigned to a writing condition (self-compassion, self-affirmation, or neutral essay) and a photo condition (UV or no-UV). Participants then reported their eye color and skin tone, which were necessary for adjusting the UV camera settings. The researcher then left the room so that participants could read instructions and complete the writing exercise on the computer. In the self-affirmation condition, participants were asked to write about why kindness toward others is important to them, referencing specific times that they have displayed kindness in everyday life (adapted from Jessop et al., 2009; Reed & Aspinwall, 1998). Participants in the self-compassion condition received the same instructions, but were asked to write about *self*-kindness, which was described as "treating oneself gently and with the same kindness as you would treat others." In the neutral condition, participants were instructed to write about sleep and how it influences their daily lives. In each condition, participants were asked to write (type) about 2–3 paragraphs and were given 5 min to respond to the prompt, at which point a message appeared on the screen asking the participant to alert the researcher.

Next, the researcher took a photo of the participant's face using a UV-filtered Polaroid camera, which prints a black and white image next to a UV image (Walsh & Stock, 2012; Stock et al., 2009). In the UV condition, participants were shown these photos side-by-side for comparison. The researcher briefly explained what the UV photo revealed, pointing out evidence of skin damage and explaining that "any dark, freckled, or pitted areas are signs of existing sun damage to the skin" (Walsh & Stock, 2012; Stock et al., 2009). They also noted that exposure to UV light is a risk factor for skin damage and cancer, and briefly listed ways to prevent harm in the future. In the no-UV condition, the UV lens on the camera was covered so that participants only received a black and white photo of their face. In both conditions, the researcher then placed the photo on the desk and left the room.

Finally, participants completed a survey about their mood and skin protection cognitions. Following the survey, participants were debriefed and told to help themselves to any of the sunscreen packets in a prominently placed bowl on their way out of the laboratory.

Measures

Baseline variables

Skin protection (*mean of 7 items*, α = .73) At T1, participants reported how often they engage in behaviors to protect their skin from the sun including using sunscreen, wearing protective clothing, and staying indoors. Response options ranged from 1 (*never*) to 7 (*always*).

Skin tone Upon arrival to the lab (T2), participants indicated their skin tone by responding to the question: "Suppose you are not wearing sunscreen and it is the first day of the spring that is warm enough to be outdoors in a swimsuit. What would happen to your skin if you were to go out for an hour in the midday sun wearing a swimsuit? (Check only the one that best describes how previously unexposed skin would respond)." Options included: (1) always burn, not tan; (2) usually burn, tan minimally, (3) sometimes burn, usually tan; (4) rarely burn, tan well; (5) not burn at all, dark tan; (6) not burn at all, I am naturally dark skinned (Fitzpatrick, 1988).

Post-manipulation variables

Perceived skin damage (*single item*) One item assessed participants' perception of their own skin damage: "Compared to others of my age and gender, I currently have significant

Table 1 Correlations, means, and standard deviations of the primary study variables

	1	2	3	4	5	6	7	8	9
1. UV Condition	1								
2. Skin Tone	.000	1							
3. Past Sun Protection Behavior	− .023	− .33***	1						
4. Negative Mood	.39***	− .07	− .03	1					
5. Perceived Skin Damage	.37***	− .01	− .12	.25**	1				
6. Absent Exempt	− .17*	.09	− .07	− .06	− .04	1			
7. Perceived Vulnerability	.23**	− .30***	.02	.29***	.42***	− .35**	1		
8. Intentions to Protect Skin	.24**	− .26**	.37***	.22**	.05	− .12	.21**	1	
9. Did the participant take sunscreen packs?	.12	− .04	− .01	.15	− .03	− .04	.08	.17*	1
Means	*	3.24	3.38	2.30	2.97	2.47	3.63	3.90	.55
SD	*	1.39	.92	.57	1.36	1.53	1.20	1.12	.50
Range	0 = No-UV, 1 = UV photo	1–6	1–7	1–5	1–7	1–7	1–7	1–7	0 = No, 1 = yes

*** < .001, ** < .01, * < .05

underlying UV damage to my face" on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*; Walsh & Stock, 2012).

Negative Mood (*mean of 18 items*, α=.95) Participants rated the extent to which they were experiencing a specific mood (e.g., Right now, I feel…anxious, stupid, dread) on a scale from 1 (*very slightly/not at all*) to 5 (*extremely*; Mahler, 2014). Principle components analysis showed that all items loaded on a single factor.

Absent-exempt thinking (*single item*) Participants reported their agreement with the statement "If I have not experienced skin damage by now, I am probably not going to get it" on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

Perceived vulnerability to skin cancer/damage (*mean of* 2 *items*, $r = .66$). Participants estimated the likelihood that they would get skin damage and skin cancer at some point in their lifetime on a scale from 1 (*not at all likely*) to 7 (*very likely*; Gibbons et al., 2005; Walsh & Stock, 2012).

Sun protection intentions (*mean of* 5 *items*, α = .74) Five items assessed participants' intentions to protect their skin from the sun in the next 6 months on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*; e.g., "In the next 6 months… I plan to limit UV exposure whenever possible (e.g., by staying inside or seeking the shade)" (Heckman et al., 2011).

Sunscreen packets taken Six sunscreen packets were placed in a bowl in the experiment room. Following the debriefing, the researcher indicated that the participant could take as many packets as they liked on their way out, and the number taken was recorded (Walsh et al., 2014). Because only 54.5% of participants took sunscreen packets, this variable was dichotomized (taking or not taking any packets).

Results

Descriptive analyses

Table 1 presents means, standard deviations, and correlations for the primary variables.

Randomization checks

We ran three randomization checks to determine whether there were differences in the percent of White participants, skin tone, and past skin protection behavior among the writing and UV conditions. Chi Square analyses showed that the percent of White students was statistically equivalent across all six conditions ($\chi^2 = 3.61$, $p = .607$). A 3x2 ANOVA found no differences in skin tone based on UV condition, writing condition, or their interaction (all $ps > .3$). For past protection behavior, there was no effect of UV Condition, but there were significant differences based on writing condition ($F(2, 161) = 3.45$, $p = .034$). Pairwise comparisons found that participants in the neutral condition had lower past skin protection behavior than those in the self-compassion group ($p = .04$). Therefore, we chose to control for this variable in the analyses. Despite the successful randomization of skin tone, we also controlled for skin tone because this variable is such an important predictor of skin protection behavior, and previous studies have controlled for either skin tone or ethnicity in their analyses (e.g., Dwyer et al., 2015; Mahler et al., 2013; Stock et al., 2009).[1]

[1] The pattern of results did not change when analyses did not control for skin tone and past skin protection behavior.

Table 2 Pairwise comparisons table

	No-UV condition			UV condition		
	Neutral	Self-affirmation	Self-compassion	Neutral	Self-affirmation	Self-compassion
Negative mood	1.28^{a}	$1.49^{a,b}$	1.32^{a}	2.07^{c}	$1.76^{b,c}$	1.79^{c}
Absent exempt	$2.70^{a,b}$	$2.63^{a,b}$	2.79^{a}	2.09^{b}	$2.42^{a,b}$	1.97^{b}
Perceived skin damage	2.09^{a}	$3.06^{b,c}$	$2.47^{a,b}$	3.89^{d}	$3.16^{c,e}$	$3.59^{d,c,e}$
Perceived vulnerability	3.25^{a}	3.56^{a}	3.35^{a}	4.60^{b}	3.66^{a}	3.69^{a}
Intentions to protect skin	$4.45^{a,b}$	3.99^{a}	$4.17^{a,c}$	$4.99^{b,c}$	$4.65^{b,c}$	4.82^{b}
Probability of taking a sunscreen packet	0.65^{a}	0.55^{a}	0.29^{b}	$0.52^{a,b}$	0.70^{a}	0.62^{a}

All analyses control for past behavior and skin tone. Means that do not share a subscript are statistically different ($p < .05$), accounting for all possible comparisons across the six cells

Statistical analyses for hypothesis tests

2 x 3 ANCOVAs controlling for past skin protection behavior and skin tone assessed the impact of photo condition (UV vs. no-UV), writing condition (self-affirmation vs. self-compassion vs. neutral), and their interaction on continuous outcome variables (see Table 2 for all pairwise comparisons). Logistic regression with the same model was used to predict the dichotomous behavioral variable.[2]

Negative mood

There was a main effect of photo condition on negative mood ($F(1, 157) = 36.70$, $p < .001$, $\eta_p^2 = .189$), such that participants who saw their UV photo reported worse mood ($M = 1.87$) than those in the no-UV condition ($M = 1.36$). There was no main effect of writing condition ($F(2, 157) = .64$, $p = .531$, $\eta_p^2 = .008$), but results indicated an interaction between writing condition and UV condition ($F(2, 157) = 3.06$, $p = .050$, $\eta_p^2 = .037$). Pairwise comparisons found that the UV photo (vs. no-UV) was more strongly associated with higher negative mood among participants in the neutral ($p < .001$, [95% CI .488, 1.092]) and self-compassion conditions ($p = .002$, [95% CI .184, .745]), but not in the self-affirmation condition ($p = .056$, [95% CI −.007, .559]). Among participants who saw their UV photo, those who completed a self-affirmation exercise reported less negative mood than those who wrote a neutral essay ($p = .049$, [95% CI .001, .604], but no other differences were significant ($ps > .05$). There were also no significant differences between writing conditions in the no-UV condition ($ps > .05$).

Absent-exempt

Participants in the UV condition ($M = 2.16$) reported less absent-exempt thinking than those in the no-UV condition ($M = 2.71$; $F(1, 159) = 5.27$, $p = .023$; $\eta_p^2 = .032$). There was not a main effect of writing condition ($F(2, 159) = .14$, $p = .868$, $\eta_p^2 = .002$) nor a significant interaction ($F(2, 159) = .60$, $p = .551$, $\eta_p^2 = .007$). However, post hoc pairwise comparisons revealed that, among participants in the self-compassion condition, those who saw their UV photo had lower absent exempt thinking than those in the no-UV condition ($p = .043$, [95% CI −1.617, −.024]). No other pairwise comparisons were significant ($ps > .05$).

Perceived skin damage

There was a main effect of photo condition ($F(1, 159) = 27.67$, $p < .001$, $\eta_p^2 = .148$) on perceived skin damage. Women who saw their UV photo had higher perceived skin damage ($M = 3.55$) than those in the no-UV condition ($M = 2.54$). There was no effect of writing condition ($F(2, 159) = .12$, $p = .884$, $\eta_p^2 = .002$); however, there was a significant interaction of photo condition and writing condition ($F(2, 159) = 6.54$, $p = .002$, $\eta_p^2 = .076$). Pairwise comparisons found that within the no-UV condition, those who completed a self-affirmation essay had higher perceived skin damage than those in the neutral condition ($p = .003$, [95% CI −1.601, −.337]), but no other differences were significant ($ps > .05$). Within the UV condition, those who wrote a self-affirmation essay actually had lower perceived skin damage than those in the neutral condition ($p = .043$, [95% CI .025, 1.443]), with no other significant comparisons ($ps > .05$). Further, the UV photo was associated with greater perceived

[2] We also conducted a sensitivity analysis using only White participants, who comprised 56.4% of our sample (N = 93). The pattern of results was generally the same for all analyses assessing cognitions (with two effects no longer significant: there was no interaction of writing and UV condition on mood, and no main effect of the UV photo on absent exempt thinking). For the analyses examining whether participants took a sunscreen packet or not, the interaction was significant (whereas with the entire sample, it is only marginally significant). The pattern of the simple effects remained the same.

skin damage among women in the neutral ($p < .001$, [95% CI 1.119, 2.496]) and self-compassion conditions ($p < .001$, [95% CI .478, 1.765]), but not the self-affirmation condition ($p > .05$).

Perceived vulnerability

There was a main effect of UV photo on perceived vulnerability, such that women in the UV condition had higher perceived vulnerability ($M = 3.98$) than those in the No-UV condition ($M = 3.39$; $F(1, 159) = 12.22$, $p = .001$, $\eta_p^2 = .071$). There was no main effect of writing condition ($F(2, 159) = 1.99$, $p = .140$, $\eta_p^2 = .024$). There was also a significant UV photo x writing condition interaction ($F(2, 159) = 4.80$, $p = .009$, $\eta_p^2 = .057$). Within the neutral writing condition, those who saw their UV photo had higher perceived vulnerability ($p < .001$, [95% CI .738, 1.959]), but this was not true for the self-affirmation ($p = .723$, [95% CI − .468, .673]) or self-compassion ($p = .245$, [95% CI − .233, .908]) conditions. Within the UV condition, those who wrote a neutral essay reported higher vulnerability than those in the self-affirmation ($p = .004$, [95% CI .315, 1.573]) or self-compassion conditions ($p = .005$, [95% CI .279, 1.554]). Within the no-UV condition, there were no differences among writing conditions ($ps > .05$).

Intentions to protect skin

Women who viewed their UV photo had greater intentions to protect their skin from the sun ($M = 4.82$) than those in the no-UV condition ($M = 4.21$; $F(1, 159) = 13.43$, $p < .001$, $\eta_p^2 = .078$). There was no main effect of writing condition ($F(2, 159) = 1.76$, $p = .176$, $\eta_p^2 = .022$) and no interaction ($F(2, 159) = .05$, $p = .947$, $\eta_p^2 = .001$). However, pairwise comparisons showed that this increase in intentions was only significant for women in the self-affirmation ($p = .021$, [95% CI .101, 1.218]) and self-compassion ($p = .024$, [95% CI .084, 1.201]) conditions, not those in the neutral condition ($p = .080$, [95% CI − .065, 1.130]).[3]

Predicting sunscreen packets

Logistic regressions examined the likelihood that participants took at least one sunscreen packet. UV condition ($b = -.49$, $df = 1$, $p = .138$) and writing condition (WALD = 3.48, $df = 2$, $p = .175$) did not predict participants' likelihood of taking sunscreen. However, there was a marginally significant interaction (WALD = 5.30, $df = 2$, $p = .071$). Simple effects analyses revealed that within the no-UV condition, participants who completed a self-compassion essay were *less* likely to take sunscreen packets than those who wrote an affirmation ($p = .039$, [95% CI 1.061, 9.603]) or neutral essay ($p = .008$, [95% CI .073, .668]). Within the self-compassion condition, those who saw their UV photo were more likely to take at least one sunscreen packet ($p = .017$, [95% CI 1.270, 11.868]).

Discussion

Consistent with previous studies (Gibbons et al., 2005; Stock et al., 2009; Walsh & Stock, 2012), participants who saw their UV photo reported more negative mood, greater perceived skin damage, lower absent-exempt thinking, greater perceived vulnerability, and greater intentions to protect their skin from the sun than those in the no-UV condition. However, contrary to hypotheses, self-affirmation and self-compassion exercises did not bolster the effects of the UV photo. Among participants who saw their UV photo, those who self-affirmed actually had *lower* perceived skin damage and *lower* perceived vulnerability than those in the neutral writing condition. Also, participants within the UV photo condition who completed a self-compassion exercise had *lower* perceived vulnerability than those who wrote a neutral essay.

In the absence of a UV photo (no-UV condition), only one difference in cognitions between writing conditions emerged—participants in the self-affirmation condition had higher perceived skin damage than those in the neutral writing condition. Although this result points to a potential benefit of self-affirmation in the absence of threat, it is offset by several other findings. In fact, the UV photo was less beneficial for those in the self-affirmation condition, for whom the photo bolstered only intentions to protect skin, than those who wrote a neutral or self-compassion essay, for whom the UV photo bolstered several positive cognitions.

There was no main effect of the UV photo on the behavioral measure of whether or not participants took sunscreen packets. Post-hoc analyses suggested that the UV photo intervention only led to greater likelihood of taking a packet among participants in the self-compassion condition, not the neutral or self-affirmation conditions. However, within the UV condition, participants who wrote a self-compassion essay were functionally no more likely to take a packet than participants who wrote the other essays.

[3] We re-ran this analysis to examine skin protection intentions *without* the items measuring self-checking or skin checking by medical professionals (3 items, $\alpha = .75$). The pattern of results remained the same. There was a significant main effect of the UV photo ($F(2167) = 10.54$, $p = .001$) on intentions, but no main effect of writing condition and no significant interaction.

Implications

Self-affirmation The current findings are not consistent with previous studies demonstrating that self-affirmation increases receptiveness and responsiveness to threatening health information within the context of sun protection (Jessop et al., 2009) and UV photo interventions (Schüz et al., 2013). Instead, the current results more closely reflect findings reported in Mays & Zhao (2016) and Good & Abraham (2011), where self-affirmation led to lower acceptance of the sun protection information. For instance, participants in the current study who self-affirmed before seeing their UV photo reported lower perceived vulnerability and perceived skin damage than those who did not affirm before the intervention. The current study adds to the literature demonstrating the boundary conditions of self-affirmation, showing that not all populations and contexts are conducive to realizing the benefits of this exercise (Zhao et al., 2014; Nan & Zhao, 2012; Briñol et al., 2007).

One probable explanation for the null—and occasionally deleterious—effect of self-affirmation in the current study may be that participants were not highly threatened by the UV photo, and therefore did not respond defensively. The sample reported moderate skin protection behavior ($M = 3.38$ on a scale from 1–7). Recall that Schüz et al. (2013) found that self-affirmation mitigated defensive processing only among the high-risk participant group, who reported that being tan was especially important to them. Among the low-risk participants, self-affirmation did not affect sun protection behavior, because this group did not demonstrate defensive reactions to the photo (Schüz et al., 2013).

Several other studies demonstrate that self-affirmation is most beneficial for higher-risk groups, who experience the most threat (Briñol et al., 2007; Cohen & Sherman, 2014; Harris et al., 2007; Harris & Napper, 2005; Klein & Harris, 2009). A meta-analysis of self-affirmation interventions on healthy behavior found that effect sizes were larger when the intervention preceded a threatening message to a high-risk population (vs. did not precede a threat or preceded a threatening message to a low-risk population; Ferrer & Cohen, 2018). For example, Harris and Napper (2005) found that self-affirmation before a message on the link between alcohol and breast cancer led to greater intentions to reduce drinking among heavy, but not moderate or light drinkers. Further, among low-risk drinkers, those who self-affirmed actually had lower risk perceptions for diseases unrelated to drinking (Harris & Napper, 2005). These results echo Briñol et al.'s (2007) finding that in the absence of a threat, self-affirmation can lead to overconfidence and resistance to change. However, Mays and Zhao (2016) found a detrimental effect of self-affirmation paired with a sun protection message for a relatively high-risk sample (i.e., all participants had tanned indoors in the past year and 40% were regular indoor tanners). Therefore, the current body of literature does not yet ascertain the circumstances under which self-affirmation will be beneficial for sun protection messages.

The current research demonstrates no added benefit of self-affirmation when given personalized information on UV damage among female college students who present moderate risk for skin cancer. If a primary purpose of self-affirmation is to reduce defensiveness, the exercise may be ineffective in the absence of defensiveness.

Self-compassion This is the first study to examine the effect of a self-compassion exercise in the face of threatening health information. However, results suggest that self-compassion may operate similarly to self-affirmation, in that its benefits will not be actualized in the absence of sufficient threat. Still, with cautious interpretation, the findings seem to suggest self-compassion may be more beneficial than self-affirmation for sun protection interventions. Whereas the UV photo (vs. no-UV) bolstered only intentions to protect skin among participants who self-affirmed, the UV photo (vs. no-UV) improved *all* cognitions other than perceived vulnerability for participants who completed a self-compassion exercise.

Further, post hoc analyses show that the UV photo was only successful in improving behavior (i.e., increasing the likelihood of taking sunscreen packets) within the self-compassion condition. However, the UV photo intervention merely led self-compassion participants to have equivalent, not greater, likelihood of taking a sunscreen packet in comparison to those who saw their UV photo and wrote a neutral essay. This positive effect of the UV photo among participants who completed a self-compassion exercise is most likely driven by the fact that, in the absence of a UV photo, self-compassion participants had significantly lower likelihood of taking sunscreen than the other two groups. This finding presents preliminary evidence that self-compassion has the potential to backfire in the absence of a threat, as has been shown with self-affirmation (Mays & Zhao, 2016; Zhao et al., 2014; Good & Abraham, 2011; Briñol et al., 2007).

Limitations and directions for future research

One limitation of the current study is that the self-affirmation exercise instructed participants to write about kindness, rather than allowing them to choose their own value, as many self-affirmation interventions have done in the past (Cohen & Sherman, 2014). The purpose of this decision was to keep the intervention as close to the self-compassion exercise as possible. Jessop et al. (2009) used a similar exercise, asking participants to complete a kindness affirmation task before a message about skin protection. Those who completed this exercise reported

more positive attitudes toward and greater response efficacy for skin protection. It is possible that participants do not value kindness or practice kindness in daily life to the extent that it would self-affirm them, although this seems unlikely. The discrepant findings are more likely due to the nature of self-affirmation than the manipulation itself.

Another limitation is that the current sample reported moderate levels of skin protection at baseline, making them a fairly low-risk sample. Had the sample presented higher risk, the benefits of self-affirmation and self-compassion may have been more likely to emerge. Given the 3 x 2 experimental design, we did not have enough power to examine whether the interventions were more effective for those in the sample who did report higher risk. In light of the current findings and Schüz et al.'s (2013) findings, risk level is an important moderator to consider in future research in this domain, especially within the context of self-compassion. Similarly, this intervention may be more threatening to women who report higher appearance concerns (McClendon et al., 2002).

Another explanation for why self-affirmation and self-compassion did not bolster the effect of the UV photo is that significant differences would have been found with a larger sample. However, previous studies have found significant effects of self-affirmation in the context of health messages using similar cell sizes (Correll et al., 2004; Ko & Kim, 2010; Pavey & Sparks, 2012). Further, because significant differences were found between writing conditions in the *opposite* direction of what was expected, we suspect that the mixed findings are more likely due to the moderate risk level of the sample rather than a lack of power.

Participants' decision to take sunscreen was measured as they left the experiment, following the debriefing. Although this procedure has been used in previous studies (Dwyer et al., 2015; Walsh et al., 2014), the explanation of the study in the debriefing may have influenced their decision to take sunscreen packets. However, offering participants sunscreen packets after the debriefing mitigates suspicion that this choice was a measure in the study, reducing demand characteristics, and also ensures that the participant did not feel coerced into taking sunscreen packets by the researcher, who had already left the room.

Finally, although participants' perceived skin damage is a reasonable indication of the extent to which participants accepted the "message" of the UV photo, future studies may consider incorporating more traditional measures of message acceptance used in conjunction with self-affirmation (Epton et al., 2015). For instance, participants could be asked to rate the extent to which the photo is an accurate indication of skin damage and cancer risk.

Conclusion

The current study provides further support for the benefit of a UV photo intervention on college students' sun protection cognitions and behavior. Self-affirmation and self-compassion exercises did not enhance the effect of the UV photo intervention, potentially because the UV photo was not threatening enough to inspire defensive responses in the moderate-risk sample. Future studies should examine whether these exercises are beneficial to pair with sun protection messages among higher-risk individuals.

Compliance with ethical standards

Conflict of interest Charlotte J. Hagerman, Michelle L. Stock, Brianne K. Molloy, Janine B. Beekman, William M. P. Klein, and Nicole Butler declare that they have no conflict of interest.

Human and animal rights All procedures followed were in accordance with ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

Informed consent Informed consent was obtained from all participants for being included in the study.

References

Breines, J. G., & Chen, S. (2012). Self-compassion increases self-improvement motivation. *Personality and Social Psychology Bulletin, 38,* 1133–1143.

Briñol, P., Petty, R. E., Gallardo, I., & DeMarree, K. G. (2007). The effect of self-affirmation in nonthreatening persuasion domains: Timing affects the process. *Personality and Social Psychology Bulletin, 33,* 1533–1546.

Brown, S., & Locker, E. (2009). Defensive responses to an emotive anti-alcohol message. *Psychology and Health, 24,* 517–528.

Brown, S. L., & Smith, E. Z. (2007). The inhibitory effect of a distressing anti-smoking message on risk perceptions in smokers. *Psychology and Health, 22,* 255–268.

Buller, D. B., Cokkinides, V., Hall, H. I., Hartman, A. M., Saraiya, M., Miller, E., et al. (2011). Prevalence of sunburn, sun protection, and indoor tanning behaviors among Americans: Review from national surveys and case studies of 3 states. *Journal of the American Academy of Dermatology, 65,* S114.e1–S114.e11.

Cafri, G., Thompson, J. K., Roehrig, M., Rojas, A., Sperry, S., Jacobsen, P. B., et al. (2008). Appearance motives to tan and not tan: Evidence for validity and reliability of a new scale. *Annals of Behavioral Medicine, 35,* 209–220.

Centers for Disease Control and Prevention. (2018). Skin cancer: Behavior rates. Retrieved August 1, 2019, from https://www.cdc.gov/cancer/skin/statistics/behavior.htm

Cohen, G. L., & Sherman, D. K. (2014). The psychology of change: Self-affirmation and social psychological intervention. *Annual Review of Psychology, 65,* 333–371.

Correll, J., Spencer, S. J., & Zanna, M. P. (2004). An affirmed self and an open mind: Self-affirmation and sensitivity to argument

strength. *Journal of Experimental Social Psychology, 40,* 350–356.
Dijkstra, A. (2014). The persuasive effects of personalization through: Name mentioning in a smoking cessation message. *User Modeling and User-Adapted Interaction, 24,* 393–411.
Dwyer, L. A., Shepperd, J. A., & Stock, M. L. (2015). Predicting avoidance of skin damage feedback among college students. *Annals of Behavioral Medicine, 49,* 685–695.
Epton, T., Harris, P. R., Kane, R., van Koningsbruggen, G. M., & Sheeran, P. (2015). The impact of self-affirmation on health-behavior change: A meta-analysis. *Health Psychology, 34,* 187–196.
Ferrer, R. A., & Cohen, G. L. (2018). Reconceptualizing self-affirmation with the trigger and channel framework: Lessons from the health domain. *Personality and Social Psychology Review, 23,* 285–304.
Fitzpatrick, T. B. (1988). The validity and practicality of sun-reactive skin types I through VI. *Archives of Dermatology, 124,* 869–871.
Gibbons, F. X., Gerrard, M., Lane, D. J., Mahler, H. I., & Kulik, J. A. (2005). Using UV photography to reduce use of tanning booths: A test of cognitive mediation. *Health Psychology, 24,* 358–363.
Good, A., & Abraham, C. (2011). Can the effectiveness of health promotion campaigns be improved using self-efficacy and self-affirmation interventions? An analysis of sun protection messages. *Psychology & Health, 26,* 799–818.
Haluza, D., Moshammer, H., Kundi, M., & Cervinka, R. (2015). Public (skin) health perspectives of gender differences in tanning habits and sun protective behaviour: A cross-sectional questionnaire survey. *Wiener Klinische Wochenschrift, 127,* 124–131.
Harris, P. R., Mayle, K., Mabbott, L., & Napper, L. (2007). Self-affirmation reduces smokers' defensiveness to graphic on-pack cigarette warning labels. *Health Psychology, 26,* 437–446.
Harris, P. R., & Napper, L. (2005). Self-affirmation and the biased processing of threatening health-risk information. *Personality and Social Psychology Bulletin, 31,* 1250–1263.
Hawkins, R. P., Kreuter, M., Resnicow, K., Fishbein, M., & Dijkstra, A. (2008). Understanding tailoring in communicating about health. *Health Education Research, 23,* 454–466.
Heckman, C. J., Manne, S. L., Kloss, J. D., Bass, S. B., Collins, B., & Lessin, S. R. (2011). Beliefs and intentions for skin protection and UV exposure in young adults. *American Journal of Health Behavior, 35,* 699–711.
Holman, D. M., & Watson, M. (2013). Correlates of intentional tanning among adolescents in the United States: A systematic review of the literature. *Journal of Adolescent Health, 52,* S52–S59.
Jessop, D. C., Simmonds, L. V., & Sparks, P. (2009). Motivational and behavioural consequences of self-affirmation interventions: A study of sunscreen use among women. *Psychology and Health, 24,* 529–544.
Kasparian, N. A., McLoone, J. K., & Meiser, B. (2009). Skin cancer-related prevention and screening behaviors: A review of the literature. *Journal of Behavioral Medicine, 32,* 406–428.
Klein, W. M., & Harris, P. R. (2009). Self-affirmation enhances attentional bias toward threatening components of a persuasive message. *Psychological Science, 20,* 1463–1467.
Klein, W. M., Harris, P. R., Ferrer, R. A., & Zajac, L. E. (2011). Feelings of vulnerability in response to threatening messages: Effects of self-affirmation. *Journal of Experimental Social Psychology, 47,* 1237–1242.
Ko, D. M., & Kim, H. S. (2010). Message framing and defensive processing: A cultural examination. *Health Communication, 25,* 61–68.
Leary, M. R., Tate, E. B., Adams, C. E., Batts Allen, A., & Hancock, J. (2007). Self-compassion and reactions to unpleasant self-relevant events: The implications of treating oneself kindly. *Journal of Personality and Social Psychology, 92,* 887–904.
Lipkus, I. M., & Prokhorov, A. V. (2007). The effects of providing lung age and respiratory symptoms feedback on community college smokers' perceived smoking-related health risks, worries and desire to quit. *Addictive Behaviors, 32,* 516–532.
Maddock, J. E., Redding, C. A., Rossi, J. S., & Weinstock, M. A. (2005). Development and validation of an appearance motivation attitudes scale for sun protection. *Psychology and Health, 20,* 775–788.
Mahler, H. I. (2014). The role of emotions in UV protection intentions and behaviors. *Psychology, Health & Medicine, 19,* 344–354.
Mahler, H. I., Kulik, J. A., Butler, H. A., Gerrard, M., & Gibbons, F. X. (2008). Social norms information enhances the efficacy of an appearance-based sun protection intervention. *Social Science and Medicine, 67,* 321–329.
Mahler, H. I., 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.
Mahler, H. I., 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.
Mahler, H. I., Kulik, J. A., Gerrard, M., & Gibbons, F. X. (2013). Effects of photoaging information and UV photo on sun protection intentions and behaviours: A cross-regional comparison. *Psychology & Health, 28,* 1009–1031.
Mays, D., & Zhao, X. (2016). The influence of framed messages and self-affirmation on indoor tanning behavioral intentions in 18-to 30-year-old women. *Health Psychology, 35,* 123–130.
McClendon, B. T., Prentice-Dunn, S., Blake, R., & McMath, B. (2002). The role of appearance concern in responses to intervention to reduce skin cancer risk. *Health Education, 102,* 76–83.
McQueen, A., & Klein, W. M. P. (2006). Experimental manipulations of self-affirmation: A systematic review. *Self and Identity, 5,* 289–354.
Mohan, S. V., & Chang, A. L. S. (2014). Advanced basal cell carcinoma: Epidemiology and therapeutic innovations. *Current Dermatology Reports, 3,* 40–45.
Nan, X., & Zhao, X. (2012). When does self-affirmation reduce negative responses to antismoking messages? *Communication Studies, 63,* 482–497.
Neff, K. (2003). Self-compassion: An alternative conceptualization of a healthy attitude toward oneself. *Self and Identity, 2,* 85–101.
Pavey, L. J., & Sparks, P. (2012). Autonomy and defensiveness: Experimentally increasing adaptive responses to health-risk information via priming and self-affirmation. *Psychology & Health, 27,* 259–276.
Persson, S., Benn, Y., Dhingra, K., Clark-Carter, D., Owen, A. L., & Grogan, S. (2018). Appearance-based interventions to reduce UV exposure: A systematic review. *British Journal of Health Psychology, 23,* 334–351.
Prevent Cancer Foundation. (2019). Skin cancer. Retrieved August 1, 2019, from https://preventcancer.org/education/preventable-cancers/skin-cancer/
Reed, M. B., & Aspinwall, L. G. (1998). Self-affirmation reduces biased processing of health-risk information. *Motivation and Emotion, 22,* 99–132.
Schüz, N., Schüz, B., & Eid, M. (2013). When risk communication backfires: Randomized controlled trial on self-affirmation and reactance to personalized risk feedback in high-risk individuals. *Health Psychology, 32,* 561–570.
Sherman, D. K., & Cohen, G. L. (2002). Accepting threatening information: Self–affirmation and the reduction of defensive biases. *Current Directions in Psychological Science, 11,* 119–123.

Sirois, F. M., Kitner, R., & Hirsch, J. K. (2014). Self-compassion, affect, and health-promoting behaviors. *Health Psychology, 34,* 661–669.

Skin Cancer Foundation. (2019). Skin cancer facts. Retrieved August 1, 2019, from https://www.skincancer.org/skin-cancer-information/skin-cancer-facts

Stock, M. L., Gerrard, M., Gibbons, F. X., Dykstra, J. L., Mahler, H. I., Walsh, L. A., et al. (2009). Sun protection intervention for highway workers: Long-term efficacy of UV photography and skin cancer information on men's protective cognitions and behavior. *Annals of Behavioral Medicine, 38,* 225–236.

Sweeney, A. M., & Moyer, A. (2015). Self-affirmation and responses to health messages: A meta-analysis on intentions and behavior. *Health Psychology, 34,* 149–159.

Terry, M. L., & Leary, M. R. (2011). Self-compassion, self-regulation, and health. *Self and Identity, 10,* 352–362.

Van Koningsbruggen, G. M., Das, E., & Roskos-Ewoldsen, D. R. (2009). How self-affirmation reduces defensive processing of threatening health information: Evidence at the implicit level. *Health Psychology, 28,* 563–568.

van't Riet, J., & Ruiter, R. A. (2013). Defensive reactions to health-promoting information: An overview and implications for future research. *Health Psychology Review, 7,* S104–S136.

Walsh, L. A., & Stock, M. L. (2012). UV photography, masculinity, and college men's sun protection cognitions. *Journal of Behavioral Medicine, 35,* 431–442.

Walsh, L. A., Stock, M. L., Peterson, L. M., & Gerrard, M. (2014). Women's sun protection cognitions in response to UV photography: The role of age, cognition, and affect. *Journal of Behavioral Medicine, 37,* 553–563.

Williams, A. L., Grogan, S., Clark-Carter, D., & Buckley, E. (2013). Appearance-based interventions to reduce ultraviolet exposure and/or increase sun protection intentions and behaviours: A systematic review and meta-analyses. *British Journal of Health Psychology, 18,* 182–217.

Zhao, X., Peterson, E. B., Kim, W., & Rolfe-Redding, J. (2014). Effects of self-affirmation on daily versus occasional smokers' responses to graphic warning labels. *Communication Research, 41,* 1137–1158.