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Effects of upward and downward social comparison information on the efficacy of an appearance-based sun protection intervention: a randomized, controlled experiment

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Abstract This experiment examined the impact of adding upward and/or downward social comparison information on the efficacy of an appearance-based sun protection intervention (UV photos and photoaging information). Southern California college students ($N = 126$) were randomly assigned to one of four conditions: control, intervention, intervention plus upward social comparison, intervention plus downward social comparison. The results demonstrated that all those who received the basic UV photo/photoaging intervention reported greater perceived susceptibility to photoaging ($d = .74$), less favorable tanning cognitions ($d = .44$), and greater intentions to sun protect ($d = 1.32$) relative to controls. Of more interest, while the basic intervention increased sun protective behavior during the subsequent 5 weeks relative to controls ($d = .44$), the addition of downward comparison information completely negated this benefit. Upward comparison information produced sun protection levels that were only slightly (and nonsignificantly) greater than in the basic intervention condition and, as such, does not appear to be a cost-effective addition. Possible mechanisms that may have reduced the benefits of upward comparison information and contributed to the undermining effects of downward comparison information are discussed.

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Introduction

It has been estimated that approximately 132,000 cases of melanoma (the deadliest type of skin cancer) and between 2 and 3 million non-melanoma skin cancers are diagnosed world-wide each year (World Health Organization 2007). Ultraviolet (UV) exposure (i.e., to the sun and/or tanning beds) has been identified as a primary cause of all skin cancers (Parker et al. 1997; World Health Organization 2007). Despite evidence of increased *knowledge* regarding the health risks of UV exposure (Baum and Cohen 1998; Robinson et al. 1997; The Cancer Council, Australia 2007), the incidence of skin cancer continues to rise at a rate of ~3% per year (American Cancer Society 2007). Further, a recent report suggests that melanoma rates have increased by 50% in recent years among young Caucasian women (Purdue et al. 2008), the same population that has displayed increased sun exposure and tanning bed use (Cokkinides et al. 2006; Lazovich and Forster 2005; Robinson et al. 1997). Interventions that are effective for increasing UV protection behaviors have the potential for significant impact on skin cancer incidence.

Recent work suggests that appearance-based interventions hold promise for motivating skin cancer prevention behaviors (Jones and Leary 1994; Gibbons et al. 2005; Mahler et al. 1997, 2003, 2005, 2006, 2007). Appearance-based interventions attempt to motivate sun protection behaviors by highlighting the link between sun exposure and appearance detractors such as wrinkles, age spots, uneven pigmentation, etc. Relative to a health-based message, emphasizing negative appearance consequences may better counteract the appearance-based motivation for sun exposure (i.e., getting a tan; Hillhouse et al. 1996; Hoegh et al. 1999; Jones and Leary 1994; Miller et al. 1990; Robinson et al. 1997; Turrisi et al. 1998).

One such appearance-based intervention utilizes UV facial photographs to highlight the uneven epidermal pigmentation that results from chronic UV exposure. Particularly when combined with information regarding photoaging (premature wrinkles and age spots due to UV exposure) and prevention techniques, randomized studies have demonstrated that the UV photo intervention increased UV protection behaviors among a variety of populations for up to a year (with effect sizes generally in the medium to large range; Gibbons et al. 2005; Mahler et al. 2003, 2005, 2006, 2007; Pagoto et al. 2003). Although the UV photo/photoaging information (UVP/PI) intervention is among the most effective sun protection motivators studied to date, there is room for improvement. One potential approach for enhancing the efficacy of the intervention may be through the inclusion of social comparison information.

Social comparison

There is by now extensive documentation of the frequency with which individuals compare their personal attributes (personality, physical appearance, academic performance/ability, etc.) with those of others, and of the effects of such comparisons on self-perceptions (Suls et al. 2002; Suls and Wheeler 2000; Wheeler and Miyake 1992; Wood 1989). Although Festinger's (1954) original social comparison theory emphasized that comparisons with others who are similar to oneself (on the dimension of comparison) are preferred, subsequent work has demonstrated circumstances that motivate upward comparisons with others who are known to be relatively better off (i.e., when seeking inspiration or information for self-improvement; Collins 1996; Wood 1989) and downward comparisons with others who are worse off (i.e., when motivated to self-enhance; Wills 1981). While the bulk of the previous work has examined the effects of social comparison in non-health contexts, there is some evidence from randomized studies to suggest that social comparison information also may impact the efficacy of health risk communications (Klein and Weinstein 1997). For example, information regarding how one's own level of risk for a particular threat (disease or accident) compares to that of similar others has been associated with intrusive thoughts (McCaul and O'Donnell 1998), concern about the threat and intentions to take preventive action (Klein 2002), and future preventive behavior (Blalock et al. 1990). Also, experimental work has found that such comparative risk information can impact emotions, assessments of the safety of one's behavior, and behavior change intentions (Klein 1997). In some instances, participants have actually shown greater sensitivity to comparative risk information than objective risk information (Klein 1997, 2003; Blalock et al. 1990). Lipkus and Klein (2006), for example, found that individuals who were provided information regarding how their risk for colorectal cancer compared to others of the same age reported higher mean intentions to be screened for the disease than did controls or those provided only absolute risk information. Thus, interventions that include comparative risk information may be more effective at motivating protective behavior than those that only include objective or absolute risk information.

Overview of current experiment

The primary purpose of the present experiment was to determine the effects of including social comparison information on the efficacy of a well-established appearance-based sun protection intervention. Specifically, this experiment examined whether young adults who received photoaging information (PI) and viewed their UV photograph (UVP) would be more likely to modify their sun protection behaviors when they also saw the UV facial photos of three peers who either had more (downward comparison) or less (upward comparison) skin damage than themselves. This age group was chosen because young adults have been shown to be at relatively high risk for skin cancer due to their lack of sun protective behavior (Cokkinides et al. 2006; Robinson et al. 1997), and because melanoma rates are increasing at an alarming rate among this age group (Purdue et al. 2008). Participants were randomly assigned to one of four conditions: control, basic (UVP/PI) intervention alone, the basic intervention plus downward social comparison information, or the basic intervention plus upward social comparison information. Perceived susceptibility to photoaging, tanning cognitions, and future sun protection intentions were assessed immediately following the intervention. One month later, self-reported sun protection behaviors also were assessed via a surprise telephone follow-up.

Given extensive previous evidence of the efficacy of the basic UVP/PI intervention (Gibbons et al. 2005; Mahler et al. 2003, 2005, 2006, 2007, 2008), we expected that participants in any condition that included the basic intervention would exhibit greater sun protection intentions and behaviors than controls. However, our predictions regarding the effects of social comparison information were necessarily more tentative for a couple of reasons. First, very little previous work has manipulated upward and/or downward comparison information in a health risk context, and most of the literature that does exist has utilized hypothetical situations. For example, Klein (2003) found that participants asked to imagine that their risk of causing an automobile accident was greater than average rated their driving safety lower than did those who imagined their risk to be less than average. In addition, French et al. (2004) found that participants who were asked to imagine that their chances of developing a fictitious pancreatic disease were lower than their peers reported that they would be less disturbed/worried than did either those who imagined their risk to be greater or who were not given comparison information.

One of the few studies to our knowledge that manipulated social comparison information within a more realistic health promotion context assessed a 50–75 year old community sample for colorectal cancer risk factors before telling participants that their risk factors were or were not more numerous than average (Lipkus and Klein 2006); the results showed stronger intentions to complete a screening test among those told they had more than the average number of risks for colorectal cancer (i.e., upward comparison information) relative to those who were only provided with objective risk information (no comparison information). Closer to the present context, Hoffner and Ye (2009) more recently found that exposure to a fictitious (but realistic) newspaper article which combined a gain frame message (i.e., focus on the potential benefits to health and to skin) for sun protection and a description of a skin-healthy individual increased participants' intentions to use sunscreen relative to controls. By extrapolation, this suggests that adding UV photographs of peers with very little sun damage (upward comparison photos) to the basic intervention might increase sun protection intentions. Unexamined in previous work, however, is whether upward comparison information actually increases preventive behavior. Although behavioral intentions have long been implicated as potential precursors to behavior change (e.g., Ajzen 1991; Ajzen and Fishbein 1980), intentions are increasingly recognized conceptually and empirically as insufficient predictors of health behavior change, especially when the behavior involved is habitual (e.g., Rothman 2000; Schwarzer 2001). Thus although immediate intentions were of interest, we were especially interested in how upward comparison information affected later sun protective behavior.

Also unexamined in previous work is the effect of downward comparison information on preventive behaviors. Hoffner and Ye (2009) found that a negatively framed message about the consequences of failing to sun protect (i.e., focusing on the risks to health and to skin), in combination with a negative exemplar (description of a person with precancerous skin lesions), increased intentions to use sunscreen relative to controls, perhaps because the negative exemplar serves as a sort of fear intervention that motivates efforts to avoid a similar outcome (Lockwood 2002). However, the limited effects of fear manipulations on longer term behavior change (Mongeau 1998; Sutton 1982), in combination with work suggesting the importance of peer comparisons (Klein and Weinstein 1997), led us to anticipate that downward comparison information might have a relatively undermining effect on longer-term sun protective behavior. That is, we thought that seeing vivid images of severe skin damage sustained by peers might produce relief (relative to the intervention alone), because it could be construed as indicating one's current level of damage was less than that of others and thus one's current level of sun protection was better than that of others. The upshot might then be to decrease the behavior- change benefits of the basic intervention (which lacks comparison information); such an undermining effect, should it occur, would be of practical significance to the extent that UV photos become more widely used to motivate sun protective behaviors.

In brief summary, we anticipated that the basic UV-photo intervention (which provides no peer comparison information) would produce greater immediate sun-protection intentions and subsequent self-reported sun protection behavior than a control condition and, based on the limited previous work, that these benefits would be increased by the addition of upward comparison photos (UV photographs of peers with very little sun damage) and decreased by the addition of downward comparison photos (UV photos of peers with a great deal of sun damage). We also expected that any effects of the interventions on sun protection behaviors would be mediated by effects on tanning cognitions, perceived susceptibility to skin damage, and sun protection intentions.

Methods

Participants

One hundred twenty-six University of California, San Diego (UCSD), undergraduates received course credit for participation.[1] Seventy-seven percent were female, age ranged from 18 to 34 ($M = 19.94$, SD = 2.36), and 59.5% described themselves as Caucasian, 25.4% as Asian, 4.8% as Hispanic, .8% as African-American, 4.0% as both Asian and Caucasian, 2.4% as Caucasian and Hispanic, .8% as Caucasian and Native American, .8% as Hispanic and Native American, and 1.6% as "other". Baseline reported frequency of sunscreen use on the face was 81.4% of the time while sunbathing and 54.4% during incidental

[1] Sample size was based on power analysis: with alpha set at .05 (two tailed) and d at 1.03 based on the basic intervention versus control effect on sun protection intentions in our pilot studies, an n of 20 per group would be needed to have power greater than .87. Thus, we recruited at least 30 per condition to allow for some attrition at follow-up and to provide enhanced power for the social comparison conditions.

exposure (time in the sun engaged in activities other than sunbathing). In contrast, participants used sunscreen on their body only 64.3 and 21.8% of the time while sunbathing and during incidental exposure, respectively. Ten percent reported at least 1 h of sunbathing and 98.4% reported at least 1 h of incidental sun exposure during the prior week, and 15.2% reported using a tanning salon at least once in the past year (range = 1–60 times).[2] Two people reported a personal history of skin cancer, and 40.5% reported that at least 1 immediate or extended family member had had skin cancer.

Conditions

Participants assigned to the *intervention-only* condition received a combination of their UV photograph and photoaging information. Those assigned to the *upward comparison* or to the *downward comparison* condition in addition saw others' UV photos that depicted less or more skin damage than their own, respectively (described below). Participants in the *control* condition received none of the foregoing.

Photoaging information

Photoaging information was presented via an approximately 10-min videotaped slide show that had been updated from one developed and evaluated previously (Mahler et al. 1997, 2003, 2007). The video depicted photoaging (including graphic photos of extreme cases of wrinkles and age spots), described how UV radiation leads to photoaging, discussed effective practices for minimizing photoaging (e.g., wearing protective clothing and applying a sunscreen with a sun protection factor (SPF) of at least 15), and described proper sunscreen use (e.g., how much to apply).

UV photographs

UV facial photographs were taken with an instant Polaroid camera modified to include a 315–390 mm UV filter. UV photos dramatically highlight the non-uniform epidermal pigmentation (i.e., brown spots/blotches) that results from chronic sun exposure (see Fulton 1997, for sample photos). Each person who had a UV photo taken also had a natural-light, instant photograph taken for comparison. Participants were told that any "spotted, uneven-toned, or pitted areas" in the UV photo that did not appear in the natural-light photo indicated existing underlying skin damage that would continue to get worse if they continued their current sun exposure levels without additional sun protection.

Comparison photographs

In order to control for individual differences in attractiveness and general appearance of comparison others, we utilized photographs of the same three models (two females and one male) in both the upward and downward comparison conditions. Downward comparison photographs were created by applying make-up to each model's face to mimic the spots/blotches visible on the actual UV photographs of participants from previous studies who had a great deal of damage. Upward comparison photos were created by photographing each model without the UV filter but with a faster shutter speed to create a slightly darker image than the typical natural-light comparison photo. Thus, there was very little difference between the natural-light and "UV" photos in the upward comparison condition, leaving the impression that the models had very little damage (less than almost any individual of the same age group who has participated in several of our previous studies).

A pilot study was conducted to determine whether the photos were perceived as realistic and to select the 3 models whose photos best exemplified the upward and downward categories. A sample of 84 participants, drawn from the same population as the primary study, was randomly assigned to view and rate the skin damage depicted in either the upward or the downward comparison photos of 8 models (pictures were presented in counterbalanced order). The results demonstrated significant differences in perceived skin damage between the upward and downward photos of each of the three models selected (all $P \leq .002$). Further, extensive questioning during debrief determined that participants were not suspicious of the photos.

Procedure

Intervention session

The initial session was conducted during the spring term (April—early May; average temperature = 63°). Participants signed-up for a study titled "Health Attitudes" through the Psychology Department Human Participant Pool online sign-up system (anyone over age 18 was eligible). Participants were run individually in the lab of the principal investigator on the UCSD campus. Assignment to condition was via block randomization with block sizes of 20. The allocation sequence was generated via a computerized randomization program and was concealed from researchers who administered the interventions until each participant had received preliminary instructions and

[2] The intentional and incidental sun exposure hours are consistent with, and the sunscreen use figures are higher than, previously published population norms for San Diego residents (i.e., Newman et al. 1996).

completed the baseline and demographics measures (described below). After signing a consent form that described the study as an attempt to learn more about college students' sun exposure and sun protection behaviors, participants provided information about demographics, baseline UV exposure and protection behaviors, and completed the 6-item Public Body Consciousness scale (Cronbach's alpha = .71; Miller et al. 1981) as a measure of appearance concern. With the exception of controls, participants next viewed the photoaging video and had their UV photo taken. Participants in the intervention-only condition were shown their UV photo immediately after it was taken, whereas participants in the upward and downward comparison conditions, ostensibly while waiting for their UV photos to dry, were first shown three sets of UV/natural-light photos of "college students like yourself" who had either very little sun damage (upward comparison condition) or a great deal of sun damage (downward comparison condition). After viewing their UV photos, all participants completed the primary dependent measures (described below) and then were probed for suspicion (none was detected, i.e., participants were not aware that the comparison photos had been doctored), partially debriefed (i.e., they were told that the general goal of the study was to determine whether different kinds of information might affect sun protection intentions and beliefs), and thanked for their participation. No mention of a follow-up was made.

Follow-up

Approximately 5 weeks later ($M = 36.11$, $SD = 4.58$ days), experimenters who were blind to condition contacted 99% of the original participants by telephone (only one participant was not reached) to assess sun exposure and protection behaviors since the intervention (described below). Participants provided oral informed consent at the time of telephone contact. After completing the telephone follow-up, participants were fully debriefed. All study procedures were reviewed and approved by one of the university's institutional review boards (Fig. 1).

Measures

Manipulation checks and perceived UV damage

After viewing the UV photos of the other college students and before viewing their own, participants in the upward and downward comparison conditions completed a manipulation check item assessing their perception of the amount of sun damage in each comparison photo (1 = no sun damage;

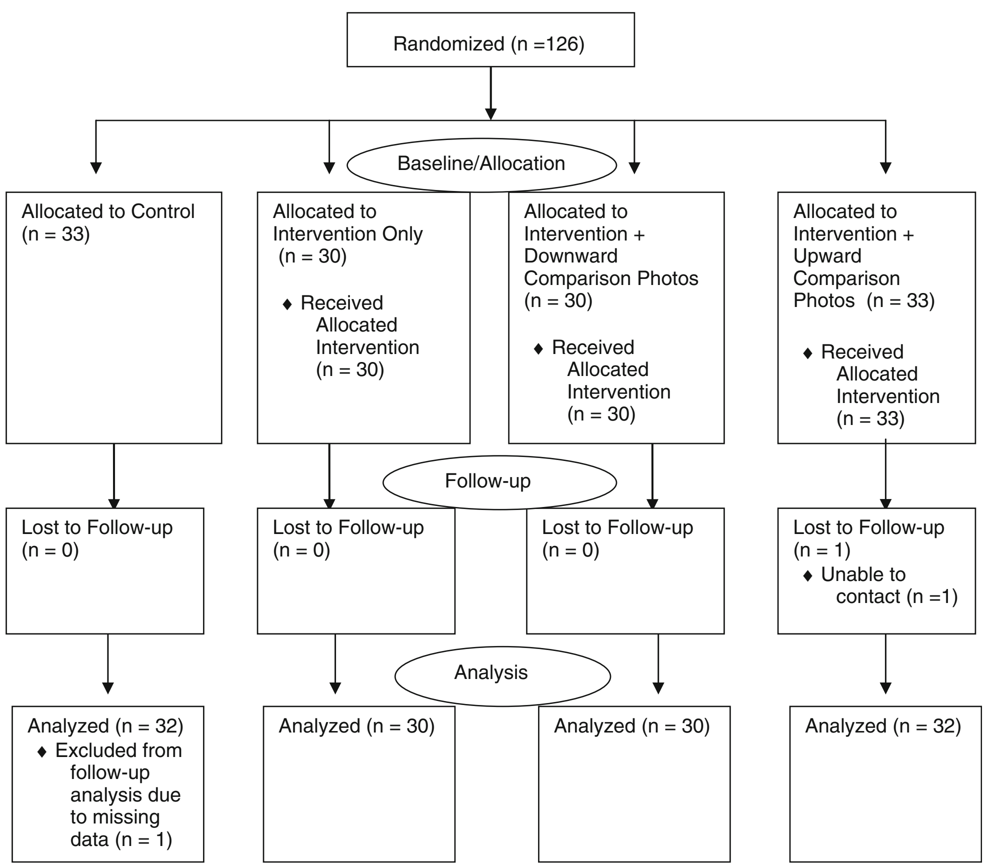

Fig. 1 CONSORT Flow Diagram

5 = a great deal of sun damage). After viewing their own UV photos, comparison-condition participants also rated their sun damage compared to each of the three comparison photos (1 = a lot less sun damage; 3 = the same amount of sun damage; 5 = a lot more sun damage).

Control and experimental participants (after viewing their UV photos) rated on separate 5-point scales (a) their perceived sun damage (1 = no sun damage to my face; 5 = a great deal of sun damage to my face), and (b) their sun damage compared to the average college student (1 = a lot less sun damage; 3 = the same amount of sun damage; 5 = a lot more sun damage).

Cognitions and intentions

All participants also completed measures of their intentions for future sun protection, their perceived susceptibility to photoaging, and their tanning cognitions. The sun protection intentions measure consisted of 12 items (e.g., "I plan to always use a sunscreen with an SPF of at least 15 on my face."; "I plan to seek out shady areas when I have to be outdoors."), and the susceptibility measure consisted of seven items (e.g., "I am too young to spend much time thinking that I might get wrinkles and age spots."; "No matter what I do, I don't think it is likely that I am going to have many wrinkles or age spots."), all rated on separate 5-point scales (1 = strongly disagree, 5 = strongly agree). We created separate intentions (Cronbach's alpha = .91) and susceptibility (alpha = .81) indices by averaging the relevant items.

As in previous work (Gibbons et al. 2005), three types of tanning cognitions (viz., tanning attitudes, prototypes, and behavioral willingness) were assessed and then combined into a tanning cognitions index. Tanning attitudes were assessed with 5 statements (e.g., "Having a tan makes me look healthy."; "Most people look better with a tan.") each rated on separate 5-point scales (1 = strongly disagree, 5 = strongly agree). These items had good internal consistency (alpha = .76) and therefore were summed to create an index. Prototypes or images of the typical person who "works at getting a tan" were assessed with four adjectives (immature, attractive, careless, cool) each rated on a 7-point scale (1 = not at all; 7 = very), which were then reversed where necessary and summed (alpha = .58). Behavioral willingness to engage in risky sun exposure was assessed with two scenarios. In the first scenario, participants imagined that they had the opportunity to go boating but had no sunscreen. They then indicated their willingness to (a) go boating unprotected, (b) go boating unprotected, but for only an hour, and (c) decline the invitation to go boating. In the second scenario, participants imagined that it was the first sunny spring day and their friends were going outdoors. They then rated their willingness to (a) go out unprotected, (b) go out unprotected, but for only an hour, and (c) go out only after putting sunscreen on all exposed areas of their skin. Ratings were made on 7-point scales (1 = not at all willing; 7 = very willing). The six items were reversed as necessary and summed to create an overall willingness index (alpha = .82). Factor analysis of the three types of cognitions extracted one factor that explained 60% of the variance. Thus, to minimize the number of statistical tests (and thereby experiment-wise error), they were standardized and combined to create the overall tanning cognitions index (alpha = .66).

Follow-up sun exposure and protection behavior

We assessed intentional sun exposure by asking participants to estimate the number of hours they had sunbathed since their participation. To assess incidental sun exposure, we asked participants to estimate the average number of hours they had spent in the sun while engaged in activities other than sunbathing on a typical weekday and weekend, respectively. To minimize the number of statistical tests, we then created an overall index of *sun exposure* by standardizing (via *z*-scoring) and averaging the foregoing single intentional and two incidental sun exposure measures. (An index of baseline sun exposure was similarly created using the corresponding baseline measures of sun exposure).

To assess sun protection behavior, participants were asked (a) whether they had used sunscreen during intentional and incidental exposure, respectively, since the experiment and, if so, (b) the frequency with which they had used sunscreen on their face and body (on scales ranging from 0 to 100%); (c) whether they had purchased any sunscreen since participation in the experiment; and (d) the frequency with which they had done each of the following since the experiment: considered buying a wide-brimmed hat, browsed the sunscreen section at a store, discussed sunscreen with a friend, reapplied sunscreen during the day, used a thicker layer of sunscreen than they previously would have (on 5-point scales, 1 = not at all; 5 = very frequently). We created an overall index of *sun protection* subsequently by standardizing and averaging the foregoing items. (A baseline sun protection index was similarly created using the corresponding protection items assessed at baseline).

Results

Preliminary analyses

Group equivalence

To determine the initial equivalence of the conditions, separate one-way analyses of variance (ANOVAs) were performed on the demographic and baseline sun protection variables. The results indicated no significant differences or trends in age, gender, ethnicity, or education level ($P > .22$, $d < .42$). There also were no differences in intentional or incidental sun exposure at baseline, sun-reactive skin type (Fitzpatrick 1988), family history of skin cancer, or the frequencies of sunscreen use on either the face or body during incidental or intentional sun exposure ($P > .11$, $d < .53$). Thus, it appears that participants were effectively randomized to condition.

Social comparison manipulation checks

A *t*-test demonstrated, as expected, that participants in the upward comparison condition perceived the model photos as displaying, on average, significantly less skin damage ($M = 3.26$, SD = .51) than did participants in the downward comparison condition ($M = 4.24$, SD = .49), $t(61) = 7.80$, $P < .001$, $d = 2.00$. In further support of the effectiveness of the social comparison manipulation, an additional *t*-test demonstrated that upward comparison participants rated their own UV damage as significantly greater relative to the 3 models ($M = 4.31$, SD = .69) than did downward comparison participants ($M = 1.56$, SD = .85), $t(61) = 14.22$, $P < .001$, $d = 3.64$.

Perceived UV damage

A oneway ANOVA on participants' ratings of the damage displayed in their own UV photos showed a significant condition effect, $F(2, 90) = 30.42$, $P < .001$. Post-hoc analyses demonstrated that those in the downward comparison condition perceived their skin damage as significantly less ($M = 2.73$, SD = 1.05) than did those in either the intervention-only ($M = 3.62$, SD = .93) or upward conditions ($M = 4.45$, SD = .62), which also significantly differed from one another (all $P < .001$, d ranged from .91 to 2.06). There was also an overall significant condition effect on participants' ratings of their skin damage relative to the average college student, $F(2, 90) = 53.87$, $P < .001$. Again post-hoc analyses demonstrated that all three means differed significantly from one another (all $P < .001$, d ranged from .97 to 2.41), with downward comparison participants rating their damage relative to the average college student as less ($M = 2.15$, SD = .96) than did those in the intervention-only ($M = 2.92$, SD = .62) or the upward comparison conditions ($M = 4.20$, SD = .77).

Primary analyses

The primary analyses were conducted utilizing several planned contrasts (Keppel 1973). Specifically, to test the prediction that all intervention conditions would display greater sun protection intentions and behavior than controls, the three intervention conditions were combined and contrasted against the control condition. A second contrast tested the hypothesis that the addition of upward, relative to downward comparison photos to the basic intervention would result in greater prevention efforts. Finally, we also examined whether the addition of either upward or downward comparison information altered the effects of the basic intervention by separately contrasting each of these conditions against the intervention-only condition. Given previous evidence that appearance concern may moderate the effects of appearance-based interventions (e.g., Jones and Leary 1994), all analyses were conducted controlling for appearance concern scores. Analyses of follow-up sun exposure and protection also controlled for baseline sun exposure or protection, respectively. In all instances in which ANOVA and analysis of covariance (ANCOVA) are used, preliminary analyses indicated that all assumptions were met. Means and standard deviations for each outcome as a function of condition are in Table 1.

Table 1 Means (and standard deviations) of outcomes as a function of conditions

Measure	Control ($N = 33$)	Intervention only ($N = 30$)	Intervention + Downward comparison photos ($N = 30$)	Intervention + Upward comparison photos ($N = 33$)
Intentions to sun protect (1 = low; 5 = high)	3.08 (.91)	3.93 (.73)	3.94 (.54)	4.14 (.60)
Perceived Susceptibility to photoaging (1 = low; 5 = high)	3.38 (.85)	3.86 (.72)	3.83 (.75)	3.99 (.71)
Tanning cognitions index (higher z scores = more favorable)	.24 (.79)	−.24 (.77)	−.03 (.75)	.01 (.73)
Sun exposure index (lower z scores = less exposure)[a]	.09 (.68)	.02 (.70)	−.06 (.86)	−.05 (.70)
Sun protection index (lower z scores = less protection)[b]	−.18 (.65)	.15 (.54)	−.18 (.67)	.21 (.69)

Intentions, perceived susceptibility, and tanning cognitions were assessed during the initial session immediately following the intervention. Sun exposure and protection were assessed at the 1-month follow-up. All means are adjusted for appearance concern. The sun exposure and protection index means are adjusted for the appropriate baseline covariate

[a] Due to missing data, the upward comparison mean is based on 32 participants

[b] Due to missing data, the upward comparison and control group means are based on 32 participants

Perceived susceptibility, tanning cognitions, and intentions

Consistent with previous work, those who received the basic intervention (photoaging information + UV photo) alone or with social comparison information reported significantly less favorable tanning cognitions (t (121) = −2.13, $P < .04$, $d = .44$), greater perceived susceptibility to photoaging (t (121) = 3.58, $P < .001$, $d = .74$), and stronger intentions to use sun protection regularly in the future, (t (121) = 6.39, $P < .001$, $d = 1.32$) relative to those in the control condition (see Table 1 for condition means and standard deviations). However, there were no differences in perceived susceptibility, tanning cognitions, or sun protection intentions among the three intervention conditions (all $P > .18$, all $d < .21$).

Sun exposure

An ANCOVA, controlling for the baseline sun exposure index and appearance concern, was conducted on the 5-week follow-up sun exposure index. The results demonstrated, not surprisingly, that people with higher sun exposure at baseline also reported continued higher exposure levels at follow-up, t (119) = 6.82, $P < .001$, $d = 1.25$. However, controlling for baseline levels, sun exposure at follow-up did not differ as a function of conditions (all $P > .36$, all $d < .17$).

Sun protection

An ANCOVA on the follow-up sun protection index, which controlled for the baseline sun protection index and appearance concern, showed, as one would expect, that people with higher sun protection levels at baseline reported having continued higher protection levels during the 5-week follow-up period, t (118) = 6.38, $P < .001$, $d = 1.17$. In addition, those higher in appearance concern reported greater sun protection, t (118) = 2.67, $P < .01$, $d = .49$. Separately, those who received the intervention alone or with social comparison information on average reported greater sun protection than did controls, t (118) = 2.07, $p = .04$, $d = .44$. Of more interest, those in the upward comparison condition reported significantly greater sun protection at follow-up than did those in the downward comparison condition, t (118) = 2.76, $P = .01$, $d = .51$. In fact, as can be seen in Table 1, participants in the downward comparison condition reported the same level of sun protection at follow-up as participants who had received no intervention (controls). In that the intervention-only group had higher protection levels than controls ($P = .02$, $d = .42$), the downward comparison photos, in effect, thus negated the benefits of the basic intervention. As is also shown in Table 1, the mean sun protection for the intervention-only condition fell between those of the upward and downward comparison conditions, with downward comparison photos significantly decreasing ($P = .02$, $d = .42$) sun protection, whereas the upward comparison condition mean was non-significantly higher than the intervention only mean ($P = .67$, $d = .08$).

Mediation analyses

We next explored whether the intervention effects on sun protection behaviors may have been mediated by tanning cognitions, perceived susceptibility to skin damage, and sun protection intentions. Because there were no differences between the three intervention conditions on the proposed mediators, the interventions were combined for these analyses and contrasted against the control condition. Consistent with the foregoing results, a regression of sun protection behavior on intervention condition, controlling for baseline sun protection and appearance motivation, revealed a significant effect of the interventions, $b = .24$, s.e. = .117, $P = .04$). To then test the total indirect (mediational) effect of tanning cognitions, perceived susceptibility, and sun protection intentions in addition to their respective, specific indirect effects, we used the bootstrapping procedures detailed by Preacher and Hayes (2008) for multiple mediator models. To indicate the nature of mediation relationships, the Preacher and Hayes (2008) technique generates point estimates and bias-corrected and accelerated (BCA) confidence intervals (see Efron 1987) for the total indirect effect of the mediators as a set and also for the separate, indirect effects of the individual mediators (controlling for the other mediators). Confidence intervals that do not include zero suggest significant mediation.

Our analyses used an SPSS macro by Preacher and Hayes (2008) to generate 5,000 bootstrap re-samples of the data without replacement. The results indicated that the total indirect effect of the intervention on sun protection through tanning cognitions, perceived susceptibility, and sun protection intentions was significant, with a point estimate of .21 (95% BCA-CI: .05 to .40), and that the remaining direct effect of the intervention on sun protection was reduced to nonsignificance ($b = .03$, $P > .81$). Although the results thus support a significant overall mediation effect of these variables, examination of the specific indirect effects revealed that none was uniquely significant: tanning cognitions point estimate = .01, (95% BCA-CI: −.02 to .10); perceived susceptibility point estimate = .04 (95% BCA-CI: −.02 to .14); sun protection intentions point estimate = .15 (95% BCA-CI: −.02 to .35).

Discussion

To our knowledge this is the first experiment to examine how the provision of upward and downward social comparison information impacts health promotion behavior in an actual, as opposed to hypothetical, health risk situation. This study also differed from the existing literature in that the social comparison information was not delivered through explicit statements of relative risk, e.g., "your risk is greater than average"; instead participants were provided with images designed to implicitly convey better or worse status, specifically, less or more sun damage than a group of peers.

Within this context, we found social comparison information did not influence immediate cognitions (participants who received the basic intervention, which was a combination of UV photo and photoaging information, felt more susceptible, had less favorable tanning cognitions, and expressed greater intentions to sun protect than controls, regardless of whether they also received upward or downward comparison information) but did affect later sun protective behaviors. It is possible that more explicit social comparison information (e.g., "your risk is greater than average"), because it is less open to interpretation (and self-serving distortion) than non-labeled photos of others, would provide a more differentiated pattern of immediate cognitions. This can certainly be tested in future work. However, we suspect that the greater impact of social comparison information on later behavior than on immediate cognitions that we found may actually reflect the process of behavior change. That is, in the moment, what may be most salient to participants are their UV photo and the photoaging information (both of which tend to be rather shocking for participants). When first confronted with vivid evidence of one's actual underlying skin damage and how one may eventually look to the naked eye, it is perhaps not surprising that *all* participants, regardless of whether they also saw photos of others, felt vulnerable and intended to take action. Even seeing others with more damage (downward comparisons) may initially provide cold comfort. In line with this, albeit anecdotal, we had a number of participants in the downward comparison condition make statements along the lines of, "I'm glad I'm not as bad as them, and I don't want my face to get that bad…I need to make some changes."

It is relatively easy of course to intend to change habitual behavior but much more difficult to make and maintain change (see discussions by Rothman 2000; Schwarzer 2001). We found no evidence, for example, that participants in any of the intervention conditions significantly changed how much time they spent in the sun (sun exposure) compared to controls, a null effect we have seen previously (e.g., Mahler et al. 2005, 2007) and that is perhaps not surprising given that the photoaging video emphasizes sun protection (e.g., sunscreen use) rather than the avoidance of sun exposure. We did find, however, that the basic intervention increased sun protective behavior during the subsequent 5 weeks, and that the addition of upward comparison information to the basic intervention did not significantly increase subsequent sun protection. In sharp contrast, the addition of downward comparison information effectively negated the benefit of the basic intervention to the point where protection levels were virtually identical to controls and were significantly lower than in the upward comparison condition.

Null effects of course must always be interpreted with caution, as it remains possible that other operationalizations (in this case of upward comparison information) could produce more substantial positive effects. That caveat aside, we found no compelling evidence to suggest that the simple addition of upward comparison peer information is likely to be a means by which to enhance the efficacy of the basic UV-photo intervention. As a practical matter, our results therefore indicate that the basic UV-photo intervention is relatively more cost-effective. Work in other, non-health areas has suggested upward comparisons can be inspirational if (and perhaps only if) individuals believe they can eventually attain a similar high level (e.g., Lockwood and Kunda 1997; Taylor and Lobel 1989; Testa and Major 1990). In the present case, participants' own UV photos indicated permanent damage that they had already done to their skin, so it was literally impossible, no matter how much sun protective behavior they performed in the future, for those in the upward comparison condition ever to achieve the level of skin health depicted in the peer photos. Perhaps this immutable fact dampened the impact of the upward comparison peers. Additional research will be needed to determine if upward comparison information might be more beneficial if, for example, participants are led to believe that future sun protective behavior could reduce their existing damage to the levels of the upward comparison peers.

Future research will also be needed to determine the mechanisms by which the downward comparison information undermined the basic UV-photo intervention effects. As already noted, we found no evidence that seeing others who had worse damage at the time of the intervention left participants with more favorable tanning cognitions, or feeling less susceptible to sun damage or less intent on increasing sun protective behavior than intervention-only participants. However, as all intervention participants encountered the inevitable difficulties of actually altering habitual behaviors, those who had seen the downward comparison photos seem to have had more difficulty adopting protective behaviors. We speculate that with time, those with downward comparison information may have been able to take comfort by rationalizing that their previous sun habits had resulted in much less skin damage than the average person their age, and therefore that major changes were not absolutely necessary. Thus it may be that some time after initial exposure to threatening information (in this case, vivid evidence of one's previously unrecognized skin damage) is generally needed before thoughts of downward comparison can gain traction, providing comfort and influencing behavior. It will also be important for future work to examine the emotional effects of downward versus upward comparison information. There is growing evidence that affect may play an important role in health behavior decision-making (Lawton et al. 2007; Trafimow et al. 2004). It is possible, for example, that the negative emotional impact of the intervention is muted when paired with downward comparison photos and this may make it subsequently more difficult to sustain intended sun protection efforts.

Methodological/interpretive issues

This experiment had several methodological strengths additional to randomization and statistical control of baseline status. First, all of the outcome measures had been utilized successfully in several previous studies, allowing for better integration of the present findings with the existing literature. Perhaps most important, this experiment went beyond the hypothetical scenarios often utilized in the comparative risk literature and beyond the assessment of only immediate cognitions and behavioral intentions by utilizing an actual health threat and assessing sun protection behaviors at a 5-week follow-up. Finally, participants were not aware of this follow-up in advance, thus reducing the possibility that they altered their behavior in anticipation.

The experiment of course also had methodological limitations. First, it was conducted in a region of the country where the sun shines an average of 263 days per year. Thus, it is not possible to determine whether the interventions would have similar effects in areas with different climates. Generalizability is also limited by the fact that the sample was largely female and Caucasian, and exclusively between the ages of 18 and 34. We would note however, as mentioned previously, that this is exactly the population that has been found to have the highest increase in melanoma rates in recent years (Purdue et al. 2008) and thus the population that is most in need of effective interventions.

An additional limitation is that the follow-up, although longer than most, still was fairly short-term and relied on self-reports of sun protection behaviors. Thus, it is not possible to determine whether the interventions would alter actual behavior over a longer period of time. Several factors mitigate these concerns, however. First, we have found significant correlations between self-reported sun protection behaviors and objective measures of skin color change in previous work (Mahler et al. 2006, 2007). Such results provide validation for the self-report sun protection measures and also weaken arguments that the current results might reflect response biases of some kind. Additionally, a recent study found that the basic intervention used in this study produced objective behavior change through a 1-year follow-up (Mahler et al. 2007), so there is some reason to believe the observed effects can outlast our 5-week follow-up period. That said, we would be the first to acknowledge that follow-up studies utilizing objective measures of sun protection over longer periods of time would be desirable.

Practical implications and conclusions

Given the significant role that UV exposure plays in the development of skin cancer (American Cancer Society 2007; Parker et al. 1997) and the tremendous costs associated with treating the disease (Houseman et al. 2003), an intervention that is effective in increasing sun protection has the potential for significant impact on skin cancer incidence and health care costs. This study adds to the already considerable evidence that both UV photos and photoaging information can significantly increase sun protection behaviors (Gibbons et al. 2005; Mahler et al. 2003, 2005, 2006, 2007, 2008). This study also suggests that the effects of the intervention may be mediated in part by combined changes in tanning cognitions, perceived susceptibility to skin damage, and sun protection intentions. Further, assuming the findings involving social comparison information are replicated, they potentially have important practical implications for structuring future sun protection interventions, and perhaps for health behavior communications in general. Often health risk information is novel, ambiguous, threatening, or otherwise difficult to interpret without some comparative information. This study suggests that downward comparison information, if readily available at the time risk information is given, does not necessarily negate the immediate, cognitive impact of the risk intervention but may nonetheless dampen later behavior change.

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