



Published in final edited form as:

*Soc Sci Med.* 2008 July ; 67(2): 321–329.

## Social Norms Information Enhances the Efficacy of an Appearance-based Sun Protection Intervention

**James A Kulik, Ph.D.,**  
*University of California, San Diego*

**Heather Butler, M.A.,**  
*University of California, San Diego*

**Meg Gerrard, Ph.D.,**  
*Iowa State University*

**Frederick X Gibbons, Ph.D.,** and  
*Iowa State University*

**Heike Mahler**  
*University of California, San Diego La Jolla, CA UNITED STATES*

### Abstract

This experiment examined whether the efficacy of an appearance-based sun protection intervention could be enhanced by the addition of social norms information. Southern California college students (N=125, predominantly female) were randomly assigned to either an appearance-based sun protection intervention-that consisted of a photograph depicting underlying sun damage to their skin (UV photo) and information about photoaging or to a control condition. Those assigned to the intervention were further randomized to receive information about what one should do to prevent photoaging (injunctive norms information), information about the number of their peers who currently use regular sun protection (descriptive norms information), both injunctive and descriptive norms information, or neither type of norms information. The results demonstrated that those who received the UV Photo/photoaging information intervention expressed greater sun protection intentions and subsequently reported greater sun protection behaviors than did controls. Further, the addition of both injunctive and descriptive norms information increased self-reported sun protection behaviors during the subsequent month.

### Keywords

USA; skin cancer; sun protection; normative information; photoaging; UV photos

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Globally, the incidence of all types of skin cancers has increased over the past several decades. Between 2–3 million non-melanoma and approximately 132,000 melanoma skin cancers are diagnosed each year (World Health Organization, 2007). Skin cancer accounts for more than 50% of all new cancers diagnosed in the United States (American Cancer Society, 2006) and

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Corresponding Author: Professor Heike Mahler, University of California, San Diego La Jolla, CA UNITED STATES, hmahler@ucsd.edu.

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more than 80% of new cancer diagnoses in Australia each year (The Cancer Council, Australia, 2007). Malignant melanoma causes nearly 8,000 deaths per year in the U.S. and an additional 2,000–3,000 deaths are attributed to other skin cancers (American Cancer Society, 2006). Recreational ultraviolet (UV) exposure (i.e., to the sun and/or tanning beds) appears to be a primary cause of all skin cancers (Parker, Tong, Bolden, & Wingo, 1997; World Health Organization, 2007). Thus, interventions that effectively increase UV protection behaviors have the potential for significant impact on skin cancer incidence.

To date, the most common interventions have involved efforts to increase awareness of the link between skin cancer and UV exposure, and to inform the public about UV protection behaviors. There is evidence in both the U.S. and Australia that *knowledge* of the skin cancer-sun exposure link and of risk reduction behaviors has increased over the past 15–20 years (Baum & Cohen, 1998; Robinson, Rigel, & Amonette, 1997; The Cancer Council, Australia, 2007). Yet research suggests that young adults in particular continue to receive large amounts of both intentional and incidental UV exposure without adequate protection (Hoegh, Davis, & Manthe, 1999; Robinson et al., 1997). Because most intentional UV exposure is directed at getting a tan to improve appearance (Hillhouse, Stair, & Adler, 1996; Hoegh et al., 1999; Jones & Leary, 1994; Miller, Ashton, McHoskey, & Gimbel, 1990; Robinson et al., 1997; Turrisi, Hillhouse, & Gebert, 1998), interventions that focus exclusively on the health risks of sun exposure may not be maximally effective. Several recent studies have demonstrated the promise of appearance-based interventions, which attempt to motivate sun protection behaviors by highlighting the link between sun exposure and appearance detractors such as wrinkles, age spots, and uneven pigmentation. (Jones & Leary, 1994; Gibbons, Gerrard, Lane, Mahler, & Kulik, 2005; Mahler, Fitzpatrick, Parker, & Lapin, 1997; Mahler, Kulik, Gibbons, Gerrard, & Harrell, 2003; Mahler, Kulik, Harrel, Correa, Gibbons & Gerrard, 2005). Relative to a health-based message, messages that emphasize negative appearance consequences may better counteract the primary (appearance-based) motivation for sun exposure, namely getting a tan.

A number of recent appearance-based interventions have employed UV photography to highlight the negative appearance consequences of UV exposure (Gibbons et al., 2005; Mahler et al., 2003; 2005; 2006; Pogato, McChargue, & Fuqua, 2003). Chronic UV exposure results in uneven epidermal pigmentation which, when photographed through a UV filter, appears as brown spots/blotches (see Fulton, 1997, for sample photos). Viewing a photo of one's face with such blotches can be quite dramatic and impactful. Rather than an abstract outcome that *may* occur in the distant future, the UV photo makes the negative appearance consequences of sun exposure more salient, immediate, and certain. The findings to date are quite promising. For example, Gibbons et al. (2005) found that Iowa college students who were randomly assigned to view their UV photo reported engaging in less tanning booth use during the following month than those who did not see their UV photo. Mahler et al. (2006) also demonstrated that southern California beach patrons who saw their UV facial photo and received information about photoaging (wrinkles and age spots due to UV exposure) engaged in more sun protection behaviors during the subsequent two summer months than did controls. Further, Mahler et al. (2007) showed that college students who viewed a UV photo of their face exhibited objectively less skin tanning (via spectrometer measurement of skin color) during the subsequent summer months than those who had not seen their UV photo. Although the findings to date are promising, there remain many unanswered questions regarding how the impact of the intervention might be enhanced and how best to present the intervention in skin cancer prevention communications.

## Social Norms

One way to enhance effects of the intervention, perhaps particularly for adolescents and young adults, may be to pair it with social norms information. Social norms are beliefs about what

others do, how others think, and what others approve. Cialdini and colleagues (1991) distinguished between two types of social norms, injunctive and descriptive (Cialdini, Kallgren, & Reno, 1991). An injunctive norm refers to beliefs about what *should* be done. Specifically, it is an individual's belief of what others approve or disapprove. The belief that one *should* wear sunscreen in order to prevent skin cancer and sunburn is an example of an injunctive norm. Descriptive norms are beliefs about what others actually *do*. For example, someone might believe that most people *do not* wear sunscreen on a daily basis.

Both types of normative information have been shown to affect a variety of beliefs and behaviors. For example, both injunctive and descriptive norms have been found to influence behaviors such as littering (Cialdini, Reno, & Kallgren, 1990), recycling (Schultz, 1999), and energy conservation (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). In terms of health-related behaviors, beliefs regarding what others approve are a prominent component of the Theory of Planned Behavior (Fishbein & Ajzen, 1975), which has been shown to predict a variety of health behaviors (Hardeman, Johnston, Johnston, Bonetti, Wareham & Kinmonth, 2002). Much of the evidence for the efficacy of descriptive norms in health contexts comes from the literature on pluralistic ignorance. Pluralistic ignorance is a phenomenon in which individuals assume that their private attitudes about specific normative behaviors are different from the beliefs of others, when in reality most people share the same belief (Miller & McFarland, 1991). Pluralistic ignorance can play a role in health-related behaviors. For example, research on alcohol use among college students suggests that in general students believe that they are less comfortable with excessive drinking norms on campus than are their peers (Schroeder & Prentice, 1998). Believing their concerns about excessive drinking to be unusual, they may set their concerns aside and conform to their perceived social norm. However, when made aware that their peers *privately* share the same misgivings, students drink less than when simply provided information about the risks of excessive drinking (Schroeder & Prentice, 1998). In another context, Buunk, van den Eijnden, and Siero (2002) demonstrated that information suggesting prevalent condom use increased intentions to use condoms by making the behavior more normative. Similar effects have been found for smoking and drug use (MacKinnon, Johnson, Pentz, Dwyer, Hansen, Flay, & Wang, 1991). No previous work has examined whether descriptive norms might affect sun protection practices.

## Overview of Current Experiment

The primary purpose of the present experiment was to extend the existing literature by examining whether the efficacy of an appearance-based intervention could be enhanced by injunctive and/or descriptive norms information. Specifically, this experiment examined whether young adults who received photoaging information and viewed their UV photograph would be more likely to modify their sun protection behaviors when also provided with information that made salient that they should engage in regular sun protection and/or when informed that most of their peer group generally engaged in a good deal of sun protection. Southern California college students were randomly assigned to one of five conditions: control, UV photo and photoaging information only (the basic intervention), the basic intervention plus injunctive norms information, the basic intervention plus descriptive norms information, or the basic intervention plus both injunctive and descriptive norms information. Perceived susceptibility to photoaging and future sun protection intentions were assessed immediately following the intervention. A surprise follow-up that assessed sun protection behaviors was conducted via telephone approximately one month after the intervention.

Although young people are generally aware that tanning has health risks, the extent to which sun exposure has negative appearance consequences (i.e., photoaging) is generally more novel information. Together with salient and incontrovertible evidence from the UV photo that their face has already sustained sun damage, this should result in strong motivations to engage in

sun protection behaviors. Thus, it was expected that those participants who received at least the basic intervention would exhibit greater sun protection intentions and behaviors than controls. Also, although young adults are generally aware of the injunctive norm for engaging in sun protection, making this norm salient in the context of the basic appearance-based intervention was expected to further enhance sun protection intentions and behaviors. Similarly, it was expected that the addition of the descriptive norms information would enhance sun protection behaviors, given evidence that such information can influence alcohol, smoking, and drug use among college students. Like those activities, tanning is often a social activity that is impacted by norms. Thus if college students can be led to believe that most of their peers are engaging in regular sun protection, it should motivate similar behavior. Finally, it was expected that those who received both injunctive and descriptive norms information in addition to the UV photo/photoaging information would exhibit the greatest sun protection intentions and behaviors.

## Method

### Participants

Participants were 125 (83.2% female) University of California, San Diego, undergraduates who received course credit. Age ranged from 18 to 38 ( $M = 21.30$ ,  $SD = 2.73$ ), and 56.8% described themselves as Caucasian, 32.0% as Asian, 4.0% as Hispanic, 0.8% as African-American, .8% as Native American, and 4.0% as “other”. At baseline, participants reported sunscreen use on their face 77.4% and 54.7% of the time while sunbathing and during incidental exposure (time in the sun engaged in activities other than sunbathing), respectively. In contrast, they used sunscreen on their body 64.5% and 28.9% of the time while sunbathing and during incidental exposure, respectively. This was a high exposure group. Thirty-six percent reported spending at least one hour sunbathing, 91.4% reported at least one hour of incidental sun exposure during the prior week, and 28.8% reported using a tanning salon at least once in the past year (range = 1 – 100 times). Only 1 person reported a personal history of skin cancer, but 36.0% reported a positive family history. Sample size was based on a power analysis: with alpha set at .05 (two-tail) and  $d$  at 1.03 based on our pilot studies, an  $n$  of 20 per group would be needed to have power greater than .87. Thus, we recruited 25 per condition to allow for some attrition at follow-up.

### Intervention Materials

**Photoaging Information**—Written information regarding the incidence and causes of photoaging was provided on one side of an 8.5” × 11” laminated card. The information also included two graphic visual images of wrinkles and age spots.

**UV Photographs**—UV facial photographs were taken with an instant Polaroid camera modified to include a 315–390mm UV filter. Filtered UV light is selectively absorbed by the melanin in the skin. Thus, a photograph taken with a UV filter can dramatically highlight the non-uniform epidermal pigmentation that results from chronic sun exposure (Fulton, 1997). Each person who had a UV photo taken also had a natural-light, instant photograph taken for comparison. Participants were told that any “dark, freckled, or pitted areas” in the UV photo that did not appear in the natural-light photo indicate existing underlying skin damage that would continue to get worse if they continued their current sun exposure levels without additional sun protection.

**Injunctive Norms**—The importance of sun protection has received a good deal of media attention in recent years (perhaps even more so in sunny climates such as Southern California), and there is evidence that Americans’ awareness regarding the importance of sun protection has increased (Robinson et al., 1997). To make this injunctive norm (i.e., that one “should”

protect their skin from the sun) salient in this study, participants were provided with written information on an 8.5" × 11" laminated card that included information about proper sunscreen use (e.g., how much should be used, that a sunscreen with an SPF of at least 15 should be used, how often one should reapply) and other methods of sun protection (i.e., protective clothing and limiting exposure). This information also included one picture comparing the facial skin of a woman who had regularly used sun protection to one who had not, and another picture depicting how much sunscreen to use (an image of a palm filled with sunscreen).

**Descriptive Norms Information**—Inflated descriptive norms information was delivered orally by the experimenter. Specifically, the experimenter said “A recent survey showed that 85% of Southern California college students are now using sunscreen regularly. I’m going to play an excerpt from a focus group that we held a few months ago. The participants are undergraduates from another university here in Southern California. And in this excerpt they are talking about the recent finding that 85% of college students are now using sunscreen regularly.” Participants in the descriptive norms condition then listened to a 5-minute audiotape in which a researcher moderated a discussion among 4 college students (actually confederates) about sun protection trends. Although challenges to sun-protection were mentioned, the general tone of the discussion suggested positive attitudes towards sun-protection and indicated a high frequency of sunscreen use (i.e., the confederates generally purported to use sunscreen regularly). The moderator on the audiotape also reiterated that “85% of college students say they use sunscreen on a regular basis”, and provided some additional statistics suggesting a high sun protection norm (e.g., “80% of college students say they never sunbathe anymore”, and “most college students underestimate the number of their peers who use sunscreen regularly”). In addition, the audiotape included some discussion among the confederates about why one might not always be aware that one’s peers are using sunscreen regularly (e.g., many facial care products contain sun protection, people typically apply sunscreen in privacy much the same way that they apply face and body lotion, etc.). The primary purpose of this audiotape was to increase the credibility and acceptance of the inflated descriptive norms provided.<sup>1</sup>

## Procedure

**Initial Session**—Participants signed-up for a study titled “Health Attitudes” through the Psychology Department Human Participant Pool and were run individually. Upon arrival, participants completed a consent form that described the study as an attempt to learn more about college students’ sun exposure and sun protection behaviors. All participants then completed a questionnaire that assessed demographic information and baseline UV exposure and protection behaviors. With the exception of controls and depending upon the condition to which they had been randomly assigned, participants then either read only the photoaging information or both the photoaging and the injunctive norms information. Next participants (except controls) had their UV photo taken and shown to them. Thereafter, participants who had been randomly assigned to one of the descriptive norms conditions were provided the descriptive norm information and listened to the “focus group” discussion. Next, all participants completed a measure of their future sun protection intentions and their perceived susceptibility to photoaging. The sun protection intentions measure consisted of 18 items (e.g., “I plan to always use a sunscreen with an SPF of at least 15 on my face”; “I plan to use sunscreen

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<sup>1</sup>There has not to our knowledge been a survey of the sun protection practices of a representative sample of southern California college students. Thus, it is not possible for us to determine exactly the extent this 85% figure is inflated. However, in both the present study and several of our previous studies, we have found that at baseline, ~60% of our participants report using sunscreen on their face at least 70% of the time when engaging in incidental sun exposure, and ~78% report using sunscreen at least 70% of the time when sunbathing. Thus, it was our expectation (supported by pilot work) that the statement that “85% of southern California college students use sunscreen regularly” would convey a high descriptive norm and yet not be perceived as unrealistic. Although it was not possible to explicitly question participants about whether they believed the 85% figure without creating suspicion and jeopardizing the follow-up, a careful inquiry following the initial session did not reveal any suspicions.



on all exposed areas of my body on a daily basis.”), 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). As in previous work (Mahler, et al., 1997; 2003; 2005; 2006), both the 18 intentions items and the 7 susceptibility items displayed good internal consistency (Cronbach’s alpha = .92 and .81, respectively), and therefore separate intentions and susceptibility indices were created by averaging the relevant items. Finally, participants provided open-ended responses to the following question: “What percentage of southern California college students use sunscreen regularly?” This question was intended as a manipulation check to determine whether those in the descriptive norms conditions processed the inflated norms information they were provided.

Participants were then probed for suspicion (i.e., to determine whether they had any doubts about the descriptive norms information or the UV photos, etc. – no suspicion was detected), 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.

**One-month Follow-up**—Approximately one month later ( $M = 32.45$ ,  $SD = 4.81$  days), participants were unexpectedly contacted by telephone by experimenters who were blind to condition and who asked participants several questions regarding their sun exposure and protection behaviors during the previous month. Eighty nine percent of the original sample were reached and agreed to participate in the phone follow-up.<sup>2</sup> To assess intentional sun exposure, participants were asked to estimate the number of hours they had sunbathed since their participation. Incidental sun exposure was assessed by asking participants to estimate the average number of hours they had spent in the sun doing non-sunbathing activities on a typical weekday and weekend, respectively. In addition, participants were asked a) whether they had used sunscreen during both intentional and incidental exposure 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) whether they had used any other forms of sun protection since their participation (e.g., wore long sleeves and pants, sought shade, wore a hat, used thicker layer of sunscreen). An overall index of *sun protection* was subsequently created by first reverse scoring the sunbathing and incidental sun exposure hours measures, then standardizing (via z-scoring) and averaging all of the foregoing items (alpha = .53; in the same manner, a baseline sun protection index was created using the corresponding baseline sun protection items). Finally, participants were asked with how many family or friends (if any) they had discussed issues related to sun exposure and sun protection since participation in the study. They were then fully debriefed.

## 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. There also were no differences in intentional or incidental sun exposure at baseline, sun-reactive skin type (Fitzpatrick, 1988), personal or family history of

<sup>2</sup>Follow-up participation rates as a function of condition were as follows: control = 21, basic intervention = 23, basic intervention and injunctive norms = 24, basic intervention and descriptive norms = 22, basic intervention and both types of norms = 21. For some analyses N’s may be slightly lower due to missing data.

skin cancer, or the frequencies of sunscreen use on either the face or body during incidental or intentional sun exposure. Thus, it appears that participants were effectively randomized to condition.

**Manipulation Check**—A one-way ANOVA comparing participants' estimates of the percentage of southern California college students who use sunscreen regularly demonstrated a significant condition effect,  $F(4, 120) = 75.50, p < .001$ , effect size  $\eta = .85$ . Post-hoc comparisons showed, as was expected, that participants who (in addition to the basic intervention) received either the descriptive norms only or the descriptive plus injunctive norms information provided significantly higher estimates ( $M_s = 81.9\%$  and  $80.4\%$ , respectively) than did controls ( $M = 29.2\%$ ), those who received only injunctive norms information (in addition to the basic intervention;  $M = 35.3\%$ ), or those who had received only the basic intervention ( $M = 25.6\%$ ), all  $p_s < .001$ . In addition, the estimates of those who had received the basic intervention plus injunctive norms information were significantly higher than those of participants who had received only the basic intervention,  $p < .04$ . No other means differed significantly from one another (all  $p_s > .18$ ).

### Primary Analyses

The primary analyses were conducted utilizing a set of planned orthogonal comparisons (Keppel, 1973) that involved contrasting all four intervention conditions against the control condition, separately contrasting the three norms conditions against the basic intervention only condition, and separately contrasting the condition that included both descriptive and injunctive norms against the two conditions that included only one kind of norms information. Means and standard deviations for each outcome as a function of condition are in Table 1.

**Sun Protection Intentions**—Consistent with expectations, those who had received the basic intervention reported significantly stronger intentions to use sun protection regularly in the future ( $M = 3.28$ ) relative to those in the control condition ( $M = 2.80$ ),  $t(120) = 2.88, p < .01$ , effect size  $d = .66$ . In addition, participants who received any norms information with the basic intervention reported significantly greater sun protection intentions ( $M = 3.37$ ) compared to those who only received the basic intervention, ( $M = 3.01$ )  $t(120) = 2.06, p < .05$ , effect size  $d = .43$ . The three norms conditions did not produce differential sun protection intentions.

**Perceived Susceptibility to Photoaging**—Also as expected, all four intervention conditions resulted in significantly greater perceived susceptibility to photoaging ( $M = 3.92$ ) relative to the control condition ( $M = 3.39$ ),  $t(120) = 3.19, p < .001$ , effect size  $d = .73$ . However, there was no difference in perceived susceptibility across the four intervention conditions.

**Sun Protection Behavior**—An analysis of covariance on the 1-month follow-up sun protection behavior index which controlled for the baseline sun protection index showed, as one would expect, that people with higher sun protection levels at baseline also reported higher levels at follow-up,  $t(102) = 6.95, p < .001$ . Separately and of more interest, those who received the basic intervention reported significantly greater sun protection at the one month follow-up ( $M = 0.09$ ) than did controls ( $M = -0.28$ ),  $t(102) = 3.70, p < .001$ , effect size  $d = .94$ . Receiving either type of norms information further increased sun protection relative to the basic intervention, but not significantly,  $t(102) = 1.31, p = .19$ , effect size  $d = .30$ . However, planned contrasts showed that those who received both injunctive and descriptive norms information in addition to the basic intervention reported significantly greater sun protection ( $M = 0.23$ ) than those who received the basic intervention alone ( $M = -0.02$ )  $t(102) = 2.29, p = .04$ , effect size  $d = .59$ , and marginally greater sun protection than those who received only one type of normative information ( $M = 0.01$ ),  $t(102) = 1.79, p < .08$ , effect size  $d = .38$ .<sup>3</sup>

The impact of the intervention can be seen most dramatically when examining the percentage of participants in each condition who increased their sunscreen use during incidental exposure following the intervention compared to their baseline use. As can be seen in Figure 1, only 29% of controls reported a higher frequency of sunscreen use on their face and 14% on their body at the one-month follow-up. In contrast, in the intervention conditions, 50%–62% increased their frequency of sunscreen use on their face and 32%–57% on their body during the month following the intervention. Further, as the figure shows, a greater percentage of those who received both the injunctive and descriptive norms information increased the frequency with which they used sunscreen following the intervention compared to those who received either kind of norms information alone or those who received only the basic intervention.

**Discussion of sun exposure risk and sun protection information**—Half (49.5%) of all participants reported that they had discussed issues related to sun exposure and sun protection with at least 1 friend or family member since participation in the study. However, participants in the four intervention conditions were significantly more likely than controls (58% vs 14%, respectively) to report having discussed sun protection with friends and family in the month following the intervention,  $t(106) = 3.76, p < .001$ , effect size  $d = .93$ . There were no differences between the intervention conditions ( $ps > .64$ ).

### Mediation analyses

Finally, we conducted a series of analyses to determine whether the intervention effect on sun protection intentions was mediated by perceptions of susceptibility to photoaging and whether changes in sun protection intentions mediated the obtained intervention effects on sun protection behavior (Baron & Kenny, 1986). In these analyses, for simplicity, intervention conditions were combined (because it was the interventions versus control condition differences that were significant across all mediators and outcome measures), dummy-coded (1), and contrasted with the control condition (0). Consistent with the results reported above, these analyses established that intervention condition was significantly related to reported sun protection behaviors one month following the intervention (b coefficient = .29,  $SE_b = .10, p < .001$ ), to perceived susceptibility to photoaging (b coefficient = .28,  $SE_b = .17, p < .01$ ), and to intentions to use sun protection (b coefficient = .25,  $SE_b = .17, p < .01$ ), thereby satisfying the first two steps for establishing mediation for both dependent measures. The critical analysis to examine whether perceived susceptibility mediated the intervention effect on sun protection intentions involved regressing the intentions index simultaneously on intervention condition and the susceptibility index (Baron & Kenny, 1986). This analysis demonstrated that participants' perceived susceptibility to photoaging did significantly predict their sun protection intentions (bcoefficient = .31,  $SE_b = .09, p = .001$ ) while reducing the intervention effect on sun protection intentions to non-significance (b coefficient = .16,  $SE_b = .17, p = .06$ ). The reduction of the intervention effect was significant by the Sobel test ( $z = 2.37, p = .02$ ; Preacher & Leonardelli, 2001). Thus, these analyses suggest that the effect of the interventions on participants' future sun protection intentions was mediated by their effect on perceived susceptibility to photoaging.

Similarly, when the sun protection index was regressed simultaneously on intervention condition and the intentions index, the results demonstrated that participants' intentions to use sun protection significantly predicted reported sun protection behaviors one month later (b

<sup>3</sup>Although the separate patterns of results for sunbathing hours and hours of incidental sun exposure are similar to that reported for the overall sun protection index, these effects did not reach significance. For example, those who received the basic intervention reported fewer sunbathing and incidental sun exposure hours relative to controls but neither effect was significant ( $p = .08$  for sunbathing,  $p = .27$  for incidental hours). Also, those who received both types of norms information in addition to the basic intervention engaged in less intentional and incidental exposure than those who received only one type of norms information, but the effects were not individually significant ( $p = .12$  for sunbathing,  $p = .33$  for incidental hours).



coefficient = .40,  $SE_b = .05$ ,  $p < .001$ ) while substantially but not completely reducing the intervention effect on sun protection (b coefficient = .17,  $SE_b = .09$ ,  $p = .03$ ). The reduction of the intervention effect was significant by the Sobel test ( $z = 2.48$ ,  $p = .01$ ; Preacher & Leonardelli, 2001), suggesting that the effect that exposure to one's UV Photo and photoaging information had on subsequent sun protection behavior was mediated at least in part by the effect of the intervention on intentions to use sun protection.

## Discussion

The results of this study add to the growing literature demonstrating that utilizing UV photographs to show individuals their existing (but not currently visible) sun damage and thereby making salient the negative appearance consequences of sun exposure can be an effective method of increasing sun protection intentions and behaviors (Gibbons et al., 2005; Mahler et al., 2003, 2005, 2006, 2007). Relative to controls, nearly twice as many of those who received the UV Photo/photoaging information intervention increased their sunscreen use on their face and nearly three times as many increased the frequency with which they used sunscreen on their body in the month following the intervention. Also consistent with previous research, those who received the intervention were much more likely to share the information with friends and family members (Mahler et al., 2003; 2005). Only 14% of controls discussed sun protection with friends and family members following the study, whereas an average of 58% (46% - 71% depending upon condition) of intervention participants did so.

Moreover, this study demonstrated that the efficacy of the UV photo/photoaging information intervention may be enhanced via the inclusion of social norms information. The addition of injunctive norms information (information about what one should do to prevent skin damage from UV exposure) and/or descriptive norms information (suggesting that the majority of peer group members were engaging in regular sun protection) resulted in reliably greater sun protection intentions than did the basic intervention alone. Also, the additional combination of *both* types of normative information increased self-reported sun protection behaviors during the subsequent month.

## Possible Mechanisms

Mediation analyses demonstrated that the effect of the UV photo/photoaging information intervention on future sun protection intentions was mediated by its effect on perceived susceptibility to photoaging. There was also evidence that sun protection intentions, in turn, mediated the effect of the intervention on subsequent sun protection behavior. These findings are consistent with previous work (cf. Mahler et al., 2005, 2006, 2007).

This experiment was designed as an initial investigation of whether normative information could enhance the effects of the UV photo/photoaging information intervention. Our design does not allow us to identify the specific mechanism(s) by which the normative information operated. This is an interesting and important issue for future investigation. Indeed, there is no consensus in the existing literature regarding the cognitive processes through which normative beliefs influence behavior (Schultz, Tabanico, & Rendon, in press; Van Knippenberg, 2000). On the one hand there is work that suggests that normative influence requires little cognitive processing and may occur outside of conscious awareness (Cialdini, 2001; 2005). However, other studies suggest that normative messages must be believable and must alter normative beliefs if they are to be effective (Perkins, 2002). Although our manipulation check indicated that participants who did versus did not receive the descriptive norms information generally estimated much higher percentages of regular sunscreen use for southern California students, this does not necessarily mean that their normative beliefs were altered. It will be important for future work to carefully examine the processes through which normative information may alter health behaviors.

### Methodological/Interpretive Issues

Limitations of our study include that it was conducted at only one site (San Diego, where the sun shines an average of 263 days per year), the volunteer sample was largely female, and the follow-up was short-term and relied on self-reports of sun protection behaviors. Thus, it is not possible to determine whether the interventions would have similar effects in areas with different climates or with different populations or whether the interventions would alter behavior over a long-term (although a recent study found that the basic intervention produced objective behavior change at least through 1-year, Mahler et al., 2007). Also, it is not possible to rule out completely the possibility that the obtained differences in self-reported intentions, sun exposure, and sun protection behaviors are a function of response bias. However, it should be noted that participants in all conditions (even controls) completed all of the measures of baseline sun exposure and sun protection, etc., were debriefed regarding the general purpose of the study following the initial session, and thus were also sensitized to the issues being investigated. Thus, a pure “demand” interpretation is not consistent with our pattern of findings. Further, previous work has found significant correlations between self-reported sun protection behaviors and objective measures of skin color change (cf. Mahler, et al., 2006, 2007). Finally, the inflated descriptive norms may limit the practical utility of this intervention (i.e., practitioners may not feel comfortable providing inflated norms to patients). It will be important for future work to examine whether the same effects can be obtained with accurate descriptive norms (or with more vague descriptions such as “the great majority of college students are now using sunscreen regularly”).

This experiment also had several strengths. All outcome measures had been utilized successfully in previous work and generally demonstrated strong internal consistency in this study. Baseline sun exposure and sun protection behaviors, along with relevant demographic characteristics, were assessed and statistically controlled in the analyses, when appropriate. Perhaps most important, the experiment went beyond immediate behavioral intentions by assessing reported sun exposure and protection behaviors that occurred during the month following the intervention. Further, participants were not aware of this follow-up in advance, thus reducing the possibility that they altered their behavior in anticipation.

### Practical Implications and Conclusions

The incidences of all types of skin cancer continue to rise and, in terms of financial impact of treatment, skin cancer is among the most costly of all cancers (Houseman, Feldman, Williford, Fleischer, Goldman, Acostamadiedo, & Chen, 2003). It is believed that UV exposure plays a significant role in the cause of all types of skin cancer (American Cancer Society, 2006; Parker et al., 1997). Thus, an intervention that is effective in decreasing sun exposure has the potential for significant impact on skin cancer incidence and health care costs. There is now considerable evidence that both UV photos and photoaging information (via video or in written form) can significantly increase sun protection behaviors (Gibbons et al., 2005; Mahler et al., 2003; 2005; 2006; 2007). There is also evidence that these interventions may have effects beyond the targeted sample, given that individuals tend to share the information learned with friends and family members (see also Mahler et al., 2003; 2005). The interventions are also attractive from a cost-benefit standpoint, in that they are relatively inexpensive, brief, and can be self-administered.

This is the first experiment to investigate the effects of combining the UV photo and photoaging information interventions with descriptive norms information. It is quite common for health communications to emphasize the high prevalence of risky behaviors and the low prevalence of protective behaviors. For example, messages designed to inform the public about the causes of skin cancer often report the percentage of individuals who get sunburned each year, use tanning beds, and/or fail to use sunscreen (cf. Deegan, 2006; Rawe, 2006; Skin Cancer

Foundation, 2007). However, the propensity for humans to adhere to social norms and the accumulating evidence, from a variety of domains, that descriptive norms can influence risk behaviors, suggest that implying/stating that large numbers of individuals are engaging in risky behavior may be counter productive. The results of this experiment showed that it may be possible to enhance the efficacy of the UV photo and photoaging interventions by stating what individuals ought to be doing to protect themselves (injunctive norms) and by suggesting that a high percentage of peers actually are engaging in protective behaviors (descriptive norms). It will be important for future work to directly compare the effects of high risk versus high protection behavior descriptive norms, and to examine the mechanisms through which high protective norms increase risk reduction behaviors.

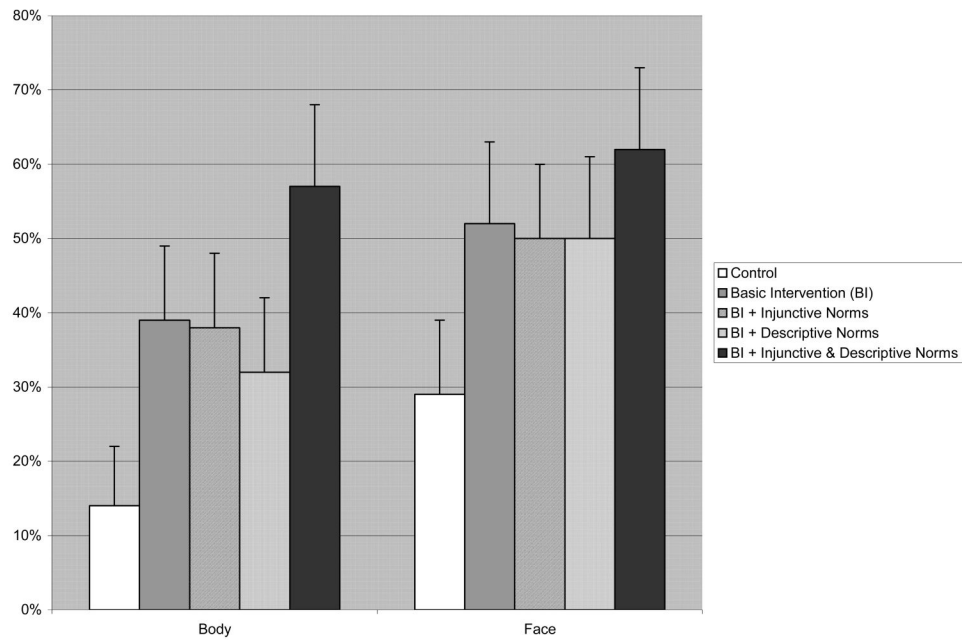
## References

- American Cancer Society. Cancer facts and figures 2006. American Cancer Society; Atlanta, GA: 2006.
- Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* 1986;51:1173–1182. [PubMed: 3806354]
- Baum A, Cohen L. Successful behavioral interventions to prevent cancer: The example of skin cancer. *Annual Review of Public Health* 1998;19:319–333.
- Buunk BP, Van den Eijnden RJM, Siero FE. The double-edged sword of providing information about the prevalence of safer sex. *Journal of Applied Social Psychology* 2002;32:684–699.
- Cialdini, RB. *Influence: Science and Practice*. 4. Boston: Allyn and Bacon; 2001.
- Cialdini RB. Basic social influence is underestimated. *Psychological Inquiry* 2005;16:158–161.
- Cialdini RB, Kallgren CA, Reno RR. A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior. *Advances in Experimental Social Psychology* 1991;21:201–234.
- Cialdini RB, Reno RR, Kallgren CA. A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology* 1990;58:1015–1026.
- Deegan, D. EPA and Shade Foundation Pitch Sun Safety at Fenway Park – National Poster Contest Announced. 2006.  
<http://yosemite.epa.gov/opa/admpress.nsf/a883dc3da7094f97852572a00065d7d8/e899964426541615852571aa00735622>. Retrieved August 6, 2007
- Fishbein, M.; Ajzen, I. *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison Wesley; 1975.
- Fitzpatrick TB. The validity and practicality of sun-reactive skin types I through IV. *Archives of Dermatology* 1988;124:869–871. [PubMed: 3377516]
- Fulton JE. Utilizing the ultraviolet (UV detect) camera to enhance the appearance of photo damage and other skin conditions. *Dermatologic Surgery* 1997;23:163–169. [PubMed: 9145957]
- Gibbons FX, Gerrard M, Lane DJ, Mahler HIM, Kulik JA. Using UV photography to reduce use of tanning booths: A test of cognitive mediation. *Health Psychology* 2005;24:358–363. [PubMed: 16045371]
- Hardeman W, Johnston M, Johnston DW, Bonetti D, Wareham NJ, Kinmonth L. Application of the Theory of Planned Behavior in behavior change interventions: A systematic review. *Psychology and Health* 2002;17:123–158.
- Hillhouse JJ, Stair AW, Adler CM. Predictors of sunbathing and sunscreen use in college undergraduates. *Journal of Behavioral Medicine* 1996;19:543–561. [PubMed: 8970914]
- Hoegh HJ, Davis BD, Manthe AF. Sun avoidance practices among non-Hispanic white Californians. *Health Education and Behavior* 1999;26:360–368. [PubMed: 10349573]
- Houseman TS, Feldman SR, Williford PM, Fleischer AB, Goldman ND, Acostamadiedo JM, Chen GJ. Skin cancer is among the most costly of all cancers to treat for the Medicare population. *Journal of the American Academy of Dermatology* 2003;48:425–429. [PubMed: 12637924]

- Jones JL, Leary MR. Effects of appearance-based admonitions against sun exposure on tanning intentions in young adults. *Health Psychology* 1994;13:86–90. [PubMed: 8168475]
- Keppel, G. Design and analysis: a researcher's handbook. Englewood Cliffs, N.J.: Prentice-Hall; 1973.
- MacKinnon DP, Johnson CA, Pentz MA, Dwyer JH, Hansen WB, Flay BR, Wang EY. Mediating mechanisms in a school-based drug prevention program: First year effects of the Midwestern Prevention Project. *Health Psychology* 1991;10:164–172. [PubMed: 1879388]
- Mahler HIM, Fitzpatrick B, Parker P, Lapin A. The relative effects of a health-based versus an appearance-based intervention designed to increase sunscreen use. *American Journal of Health Promotion* 1997;11:426–429. [PubMed: 10168263]
- Mahler HIM, Kulik JA, Gerrard M, Gibbons FX. Effects of two appearance-based interventions on the sun protection behaviors of southern California beach patrons. *Basic and Applied Social Psychology* 2006;28:263–272.
- Mahler HIM, Kulik JA, Gerrard M, Gibbons FX. Long-term effects of appearance-based interventions on sun protection behaviors. *Health Psychology* 2007;26:350–360. [PubMed: 17500622]
- Mahler HIM, Kulik JA, Gibbons FX, Gerrard M, Harrell J. Effects of appearance-based interventions on sun protection intentions and self-reported behaviors. *Health Psychology* 2003;22:199–209. [PubMed: 12683740]
- Mahler HIM, Kulik JA, Harrel J, Correa A, Gibbons FX, Gerrard M. Effects of UV Photographs, photoaging information, and use of sunless tanning lotion on sun protection behaviors. *Archives of Dermatology* 2005;141:373–380. [PubMed: 15781679]
- Miller, DT.; McFarland, C. When social comparison goes awry: The case of pluralistic ignorance. In: Suls, J.; Wills, T., editors. *Social comparison: Contemporary theory and research*. Hillsdale, NJ: Lawrence Erlbaum; 1991. p. 287-313.
- Miller AG, Ashton WA, McHoskey JW, Gimbel J. What price attractiveness? Stereotype and risk factors in suntanning behavior. *Journal of Applied Social Psychology* 1990;20:1272–1300.
- Pagoto S, McChargue D, Fugua RW. Effects of a multicomponent intervention on motivation and sun protection behaviors among Midwestern beachgoers. *Health Psychology* 2003;22:429–433. [PubMed: 12940400]
- Parker SL, Tong T, Bolden S, Wingo PA. Cancer statistics. *CA Cancer Journal for Clinicians* 1997;46:5–27.
- Perkins HW. Social norms and the prevention of alcohol misuse in collegiate contexts. *Journal of Studies on Alcohol* 2002;14:164–172.
- Preacher, KJ.; Leonardelli, GJ. Calculation for the Sobel test: An interactive calculation tool for mediation tests. 2001 Mar. Available at <http://www.unc.edu/~preacher/sobel/sobel.htm>
- Rawe J. Why teens are obsessed with tanning. *Time Magazine* 2006;168(6):54–56. [PubMed: 16958208]
- Robinson JK, Rigel DS, Amonette RA. Trends in sun exposure knowledge, attitudes, and behaviors: 1986 to 1996. *Journal of the American Academy of Dermatology* 1997;37:179–186. [PubMed: 9270501]
- Schroeder CM, Prentice DA. Exposing pluralistic ignorance to reduce alcohol use among college students. *Journal of Applied Social Psychology* 1998;28:2150–2180.
- Schultz PW. Changing behavior with normative feedback interventions: A field experiment on curbside recycling. *Basic and Applied Social Psychology* 1999;21:25–38.
- Schultz PW, Nolan JM, Cialdini RB, Goldstein NJ, Griskevicious V. The constructive, destructive, and reconstructive power of social norms. *Psychological Science* 2007;18:429–434. [PubMed: 17576283]
- Schultz, PW.; Tabanico, JJ.; Rendon, R. Normative beliefs as levers of social influence: Basic processes and real-world applications. In: Crano, W.; Prislun, R., editors. *Attitudes and Persuasion*. New York: Psychology Press; in press
- The Skin Cancer Foundation. Survey: Tanned Skin losing its appeal. 2007. <http://www.skincancer.org/press-releases/survey-tanned-skin-losing-its-appeal.html>. Retrieved August 6, 2007
- The Cancer Counsel, Australia. All about skin cancer. 2007. <http://www.cancer.org.au/content.cfm?randid=960742>. Retrieved August 6, 2007

- Turrisi R, Hillhouse J, Gebert C. Examination of cognitive variables relevant to sunbathing. *Journal of Behavioral Medicine* 1998;21:299–313. [PubMed: 9642574]
- Van Knippenberg, D. Group norms, prototypicality, and persuasion. In: Terry, D., editor. *Attitudes, behavior, and social context: The role of norms and group membership*. Mahwah, NJ: Erlbaum; 2000. p. 157-170.
- World Health Organization. *Skin Cancers*. 2007. <http://www.who.int/uv/faq/skincancer/en/index1.html>. Retrieved January 11, 2007





**Figure 1.** Percentage of participants in each condition (along with standard error bars) who increased sun protection use from baseline to one month follow-up on their face and body during incidental sun exposure.

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

Measure	Control	Photoaging Video/UV Photo (basic intervention)	Basic Intervention + Injunctive Norms	Basic Intervention + Descriptive Norms	Basic Intervention + Injunctive and Descriptive Norms
Intentions to sun protect (1=low; 5=high)	2.80 (0.54)	3.01 (0.79)	3.49 (0.75)	3.33 (0.82)	3.28 (0.82)
Perceived Susceptibility to photoaging (1=low; 5=high)	3.39 (0.82)	3.94 (0.74)	4.14 (0.84)	3.85 (0.64)	3.77 (0.64)
Sun protection index (lower z scores = less use)	-0.28 (0.44)	-0.02 (0.47)	0.10 (0.57)	-0.03 (0.42)	0.23 (0.41)
Discussed sun protection with others (0= no; 1=yes)	0.14 (0.36)	0.61 (0.50)	0.71 (0.46)	0.46 (0.51)	0.52 (0.51)